DOES NOT CIRCULATE
UNIVERSITY OF MICHIGAN
APR 15 1953
MEDICAL LIBRARY

Volume 13, Number 4
APRIL 1953

Postgraduate Medicine

Harvard School of Public Health
SPECIAL ISSUE

Official Journal
of the Interstate
Postgraduate
Medical Association

NEW (3rd) EDITION!
Graybiel, White, Wheeler and Williams' Electrocardiography
See SAUNDERS Advertisement on Pages A-10 and A-11

Microphotographs of B_{12} crystals. Their molecules are relatively mammoth in size—the largest of the water-soluble vitamins. And vitamin B_{12} is as exceptional in potency as it is in size.

In addition to specific hematopoietic activity, evidence continues to accumulate that in malnutrition, chronic illness and retarded growth in children, vitamin B_{12} supplementation yields "... statistically significant enhancement of weight gains ..."[1]

1. Chow, B.F.: Southern M.J. 45:604, July, 1952

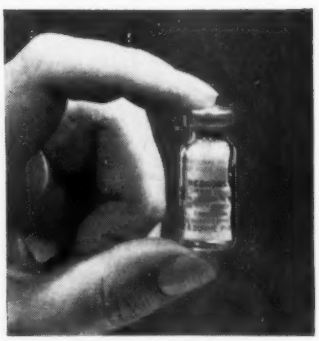
Mammoth molecule

effective

in microscopic dosage

Redisol®

CRYSTALLINE VITAMIN B_{12} TABLETS ELIXIR INJECTABLE



REDISOL, *vitamin B_{12} is available as soluble tablets; 25 mcg. crystalline vitamin B_{12}, vials of 36, bottles of 100; 50 mcg., vials of 36.* REDISOL *Elixir, 5 mcg. per 5 cc., in pint* SPASAVTR® *and gallon bottles.* REDISOL *Injectable, 30 mcg. per cc., in 10 cc. vials; 100 mcg. per cc. in 10 cc. vials.*

Vitamin B_{12}—only nutrient

therapeutically active

in *microgram dose*

Sharp & Dohme

Philadelphia 1, Pa.

Postgraduate Medicine

Volume 13 · Number 4
APRIL · 1953

OFFICIAL JOURNAL OF THE INTERSTATE POSTGRADUATE MEDICAL ASSOCIATION

TABLE *of* CONTENTS

Harvard School of Public Health Issue. GUEST EDITOR: JAMES S. SIMMONS, M.D.

Education for Careers in Public Health
JAMES S. SIMMONS, M.D. 281

The Physician's Role in Preventive Medicine and Public Health
HUGH R. LEAVELL, M.D. 287

Some Current Problems in Sanitary Engineering
EDWARD W. MOORE, M.A. AND PETER C. G. ISAAC, M.S. 292

Physiology and Environment
JAMES L. WHITTENBERGER, M.D. 299

Nutritional Research in Public Health
FREDRICK J. STARE, M.D. AND THE STAFF OF THE DEPARTMENT OF NUTRITION 304

Health Problems of Mothers and Children
SAMUEL B. KIRKWOOD, M.D., SAMUEL W. DOOLEY, M.D. AND HAROLD C. STUART, M.D. 309

Solving a Community Health Problem
JOHN E. GORDON, M.D., HUGH R. LEAVELL, M.D. AND THEODORE H. INGALLS, M.D. 318

Industrial Health
PHILIP DRINKER, CHEM. D., LESLIE SILVERMAN, D.SC., C. P. YAGLOU, M.M.E., ROBERT B. O'CONNOR, M.D. AND ROSS A. MC FARLAND, PH.D. 323

Research in Microbiology at the Harvard School of Public Health
JOHN C. SNYDER, M.D. 331

Biostatistics—and Why!
HUGO MUENCH, M.D. 334

The Importance of Tropical Public Health to World Peace
DONALD L. AUGUSTINE, D.SC., THOMAS H. WELLER, M.D. AND RUTH A. THOMAS, M.P.H. 339

(Continued on page A-6)

SCIENTIFIC EXHIBIT

Therapy of the Failing Heart
G. F. SCHMITT, M.D. 344

GENERAL PRACTICE REVIEW

Examination of the Patient with Varicose Veins
H. O. MCPHEETERS, M.D. AND C. V. KUSZ, M.D. 354

The Care of Old Rheumatic Cardiac Conditions in Later Life
N. C. GILBERT, M.D. 358

PEDIATRICS IN GENERAL PRACTICE

The Problem of Mental Deficiency in Children
LEO KANNER, M.D. 363

DEPARTMENTS

EDITORIALS 374

"A Matter of Money"

The Clinical Protection of Child Development

Medical Progress—1953

Vitamin C Restoration and Reinforcement

MEN OF MEDICINE. *Israel Spanier Wechsler,* M.D. 380

(Continued on page A-8)

THE 1953 Assembly *OF THE*

INTERSTATE POSTGRADUATE MEDICAL ASSOCIATION

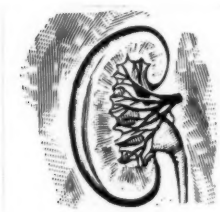
of North America

THE PALMER HOUSE, CHICAGO

November 2 to 5 (inclusive), 1953

Regitine®

(phentolamine methanesulfonate Ciba), preferred in the diagnosis of pheochromocytoma, the cause of the most common form of hypertension of *known* etiology. The injection of this *adrenergic blocking agent* affords an accurate test that is relatively safe, and can be simply performed by any physician, unassisted, in his office.



three new agents in the control of hypertension

Complete information can be obtained by writing to the Medical Service Division, Ciba Pharmaceutical Products, Inc., Summit, New Jersey.

Apresoline®

hydrochloride (hydralazine hydrochloride Ciba), an agent of choice (for use) in the treatment of hypertension. This orally effective antihypertensive is believed to act *centrally* to produce a gradual, sustained decrease in blood pressure while increasing blood flow through the kidneys.

Esomid®

chloride (hexamethonium chloride Ciba), a potent oral hypotensive agent, may be particularly valuable in those patients with severe hypertension which has failed to respond to Apresoline. Esomid acts as a *ganglionic blocker*, inhibiting the transmission of impulses through all autonomic ganglia.

P / 1907M

Ciba

LETTERS FROM ABROAD A-18

YOUR QUESTIONS ANSWERED A-26

Antabuse and Suicide

Sterility Problem

Spots Before the Eyes

Destruction of Hormones During Pregnancy Tests

Anxiety Symptoms after Coronary Thrombosis

Asthma and Bedbug Bites

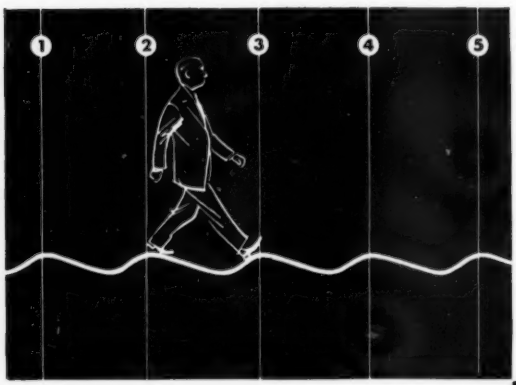
THE EDITOR'S MAIL A-34

THE MEDICAL BOOKMAN A-50

NEW DRUGS AND INSTRUMENTS A-63

DR. PEPYS' PAGES. Morris Fishbein, M.D. A-78

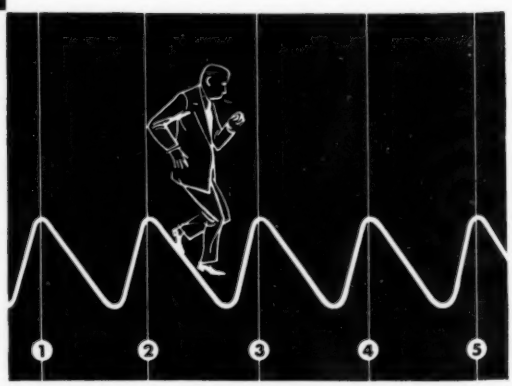
INDEX TO TECHNICAL EXHIBITS A-120



Wyeth®
Philadelphia 2, Pa.

The cardiotonic effects of all glycosides other than digitoxin are dissipated *rapidly*, making it virtually impossible to maintain the patient smoothly with a single daily dose.

The cardiotonic effect of PURODIGIN® (Crystalline Digitoxin Wyeth) diminishes *gradually*, making it easy to maintain the patient steadily at the level of digitalization needed—with a single dose daily.



Education for Careers in Public Health

JAMES S. SIMMONS*

Dean, Harvard School of Public Health, Boston

Preventive medicine—"the medicine of the future"—is an essential part of the national health program as the free world mobilizes its resources to meet the threat of international communism. If we use public health and preventive medicine to reduce sickness and accidents with the same effectiveness that we now use clinical medicine to cure the sick and injured, American physicians will conserve the nation's physical strength at a time when weakness is an invitation to disaster.

J. S. SIMMONS

In a letter received several months ago, Dr. Charles W. Mayo invited me to act as Guest Editor for this issue of *Postgraduate Medicine* with the suggestion that it might profitably contain a series of articles dealing with the various broad disciplines of public health and written by members of the faculty of the Harvard School of Public Health. I accepted Dr. Mayo's invitation with pleasure because I am proud of medicine's unique contribution to the conservation of human health. Moreover, I am convinced that public health is still in its infancy and that the profession of medicine can increase its contribution enormously through the further extension of research and education in this important field. Human health is the most valuable of our natural resources, and there has never been a time in the history of man when the human race needed so desperately to conserve its physical, mental and moral health and strength. With this in mind I should like to introduce the series of articles which follow, with a brief discussion of the potentialities involved in postgraduate education in public health.

*Dean and Professor of Public Health, Harvard School of Public Health, Boston, Massachusetts; Brigadier General, U. S. Army (retired).

The Old and the New in Medicine

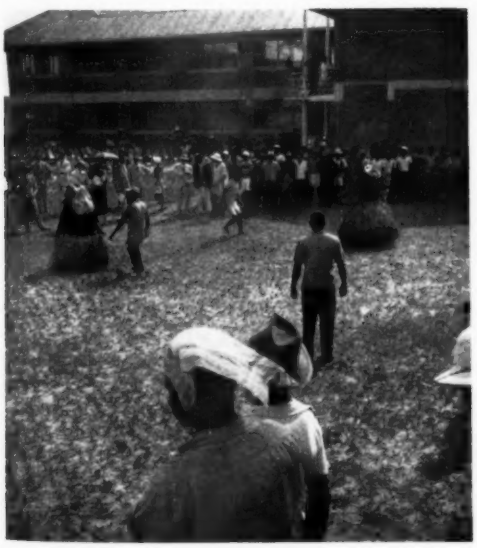
I recall a sunny tropical afternoon in January 1952 when I sat on a small balcony of the new Liberian Institute for research in tropical medicine, waiting to take part in the ceremonies dedicating these modern laboratories "to the betterment of the health and welfare of mankind." I was in the distinguished company of His Excellency, William V. S. Tubman, president of the Republic of Liberia; Dr. Joseph N. Togba, director of public health and sanitation in Liberia (who is, incidentally, a graduate of the Harvard School of Public Health); Mr. Harvey S. Firestone, Jr., president of the Firestone Plantations Company; Dr. Thomas Mackie, president of the institute and of the American Foundation for Tropical Medicine; Dr. Lowell T. Coggeshall, dean of the University of Chicago School of Medicine; Colonel Hildrus A. Poindexter of the United States Public Health Service, and other important officials.

As we sat there under the hot Liberian sun

THE NEW AND THE OLD IN MEDICINE—His Excellency W. V. S. Tubman, President of Liberia; Brig. Gen. James Stevens Simmons, Dean of the Harvard School of Public Health; Dr. Thomas T. Mackie, President of the American Foundation for Tropical Medicine; and Mr. Harvey S. Firestone, Jr., Chairman of the Firestone Tire & Rubber Company, dedicate the Liberian Institute for Tropical Medicine while (right) on the Institute grounds a native devil dancer entertains the crowd gathered for the dedication.

watching our outdoor audience gather in the chairs below, our attention was drawn to what looked like a cloud of reddish yellow dust moving slowly along a dirt road toward the institute grounds. When it came closer, we saw that under the dust was a group of 75 to 100 native villagers arranged in an informal moving circle around three native devil dancers whose heads were covered with black wooden masks horrible enough to frighten the boldest devil, and whose bodies were weaving and tossing in rhythmic frenzy. It seemed ironic that these three Liberian witch doctors were to take part in the dedication of an institute which might some day put them out of business.

The strange procession halted beside the institute and I was struck by the great contrast it afforded between the old and the new in Liberian medicine. Here were representatives of superstition, voodooism, black magic and primitive ignorance suspiciously inspecting a modern building erected to house research workers from the great universities of



the world. Watching this weird exhibition, I recalled that modern medicine is not too many years removed from practices little better than those which are the stock in trade of Liberia's witch doctors. Only a few generations ago American surgeons were operating with primitive instruments, without benefit of anesthesia or aseptic technics. Babies were being delivered under such filthy conditions that "childbed fever" was a common cause of death, and serious epidemic diseases were commonly ascribed to "telluric" influences or the emanations from decaying vegetable matter even by leaders of the profession.

We have come a long way since those dark days when the so-called "healing arts" were dominated by the devious predictions of the soothsayer, the mysterious incantations of the witch doctor or the dubious ministrations of the barber surgeon. In most of the leading countries today, speculation, superstition and quackery have given way to exact knowledge about the causes, treatment and prevention of many diseases. This new knowledge is now being applied with increasing effectiveness for the cure of the sick and injured, for the prevention of illness and the conservation of community health. Thus within the period covered by three generations the science of medicine has evolved from its humble and ineffectual beginnings, and the modern profession of medicine is now making its greatest contribution in the service of mankind.

As physicians we are proud of the spectacular advances made by our profession during these 100 years of progress. The North American practitioner of medicine no longer fears invasion of the United States by such dangerous, exotic, epidemic diseases as Asiatic cholera, European typhus, or yellow fever from the jungles of South America or Africa. Such former scourges have been excluded from our shores by effective quarantine procedures. Since World War II we have begun to boast that smallpox, typhoid, diphtheria and even malaria—all of which were prevalent a few years ago—are being rapidly brought under control. We are especially proud of the great upsurge of popular interest in medical research during and since

World War II, which has provided new agents and methods that are being used by the general practitioner, the internist, the surgeon, and by specialists in preventive medicine and public health for the conservation of the nation's health.

A New Concept of Service Through Prevention

Traditionally, the physician has always dedicated his life to a simple, clear objective, which is the relief of human suffering and, if possible, the cure of the sick and injured. Throughout the countless centuries preceding the recent birth of scientific medicine, this Hippocratic concept of rendering service to the individual patient has been the force which has bound the profession together, and today it is the symbol of our great strength. It was therefore natural that with the development of scientific medicine the new information acquired should have been applied first to the improvement of clinical medicine and surgery. Consequently, most of the great leaders in medical education during the last generation have been clinicians, and the curriculum in the average medical school has been devoted almost exclusively to disciplines concerned with the diagnosis of disease and the treatment of patients.

During this same period, however, there has gradually evolved another important concept of service through the prevention of disease. At an early period in the medical revolution, some of our greatest clinicians looked beyond their work at the sickbed to the day when the entire profession would be just as concerned with prevention as with the cure of disease. A distinguished proponent of this constructive viewpoint was Sir William Osler, who stated years ago that *preventive medicine is the medicine of the future.*

Following Sir William's time, the preventive concept has continued to grow and the medical profession has become increasingly aware of the practical importance of preventive medicine and public health. Since the Spanish-American War, military preventive medicine and its counterpart, civil public health, have become effective specialties of medicine and the entire profession is proud of their accomplishments, which are measurable in terms of the remarkable decrease in military and civilian morbidity and mortality rates during the last 50 years.

Today our country is engaged in a bitter and costly war to protect South Korea against communist aggression. Together with the other free nations, we are pouring our national resources—men, equipment and money—into the most gigantic defense program in history in an effort to block the evil designs of communism and maintain a decent, peaceful world.

Like every other loyal citizen, the American physician is searching his soul and asking himself how he and the members of his profession can increase medicine's contribution to the defense of the United States and her allies. In looking for the answer to this question, the lessons of the past are important, but they should serve only as a guide to fresh objectives and a new vision of service geared to the changing conditions of a changing world. It is therefore of practical importance to consider medicine's potentialities and to make wise plans which will insure the maximum mobilization of all our health resources for the conservation of civilian and military strength.

Better Health for the American People

America's great strength is based on just one thing—the health of her men, women and children. Therefore, as we mobilize our national resources to meet the present world crisis we must do everything possible to strengthen our national health program. This is necessary in order to safeguard the health of America's leaders, her workers and her fighting men. We should also assist our allies in the better protection of their health and manpower. In fact, such assistance is just as important as sending them armaments for the simple reason that disease-ridden nations, like sickly individuals, are unable to plan wisely, work effectively or win wars.

In order to build the strongest possible emergency health program for the nation, we should ask ourselves two questions: (1) What

are the health hazards which we now face? (2) What action should be taken to protect the American people against these hazards?

The answer to the first question is afforded by the current records of death and disability caused by disease and accidents. Last year more than two million infections were reported in the United States. The preventable intestinal, insect-borne and venereal diseases still occur. Millions of Americans are killed and injured annually by accidents, and our people are still handicapped by an enormous load of mental diseases, cancer and the afflictions of advanced age. In brief, many of our peacetime health problems are still unsolved. Moreover, if global atomic war came tomorrow, it would bring with it new and unprecedented health problems which could easily overwhelm our present health defenses.

The answer to the second question is afforded by the lessons of the recent past. Further progress in public health calls for two things. The first is research—to discover new ways to prevent disease and maintain good health. The second is to take whatever action may be required to apply this knowledge.

Another lesson pointed up by past experience is the fact that curative and preventive medicine are both important, but that the greatest health advances have come through preventive measures designed to keep large numbers of well people well. These are the lessons of the past and they are the principles which should guide us in meeting the future.

I should now like to mention certain things which I consider important to the present problem of strengthening the nation's health program. The first of these is the need for united leadership by the profession of medicine and its new specialty, the profession of public health. Since V-J Day much valuable time has been lost in heated controversies between members of both professions about the side issues, such as socialized medicine and federal health insurance, neither of which has any direct bearing on the prevention of disease. This conflict has confused our citizens and our lawmakers as to the true meaning of public health. Consequently the nation's health has become a political football, thus delaying sound national planning for an effective program of prevention. It is hoped that under the new administration these political issues will no longer interfere with progress in this field.

Another important drawback has been the lack of sufficient numbers of trained health specialists to plan, organize and operate the preventive services required by the nation. At present only about 65 per cent of our population is served by local health units, and only about one-half of our counties are served by trained, full time health officers. A recent survey showed that the 10 accredited postgraduate schools of public health in this country are training only about one-fifth of the health specialists needed under peacetime conditions and this did not include the requirements of the Armed Forces for experts in military preventive medicine. This points up graphically the present need to recruit and to provide additional facilities for the training of health specialists.

Another need is for more research aimed directly at the early solution of the unsolved problems in preventive medicine and public health. The research programs of our government agencies and of the foundations are helping to meet this need but there should be more top-level planning by men of imagination and broad vision, who can help to stimulate research in productive channels and put into action the new information as it becomes available.

It is also important that we adopt the preventive attitude as the spearhead for our health program. The country is much better prepared to handle its problems in curative medicine and curative surgery than it has ever been. Our 80 medical schools are turning out good physicians and there are now approximately 200,000 doctors in the country. The deans of the medical schools report that many of these institutions need financial assistance and this is a problem which must be faced and solved. But the chief obstacle in the development of preventive services for the country as a whole is the inadequate numbers of medical school graduates who enter our schools of public health, which are the only sources of postgraduate training in the plan-

ning, organization and administration of health programs. Vigorous recruitment of promising young physicians for training in public health is necessary, but the bottleneck will still exist as long as the schools of public health remain in their presently precarious financial situation. These 10 schools, all of which are eager to increase their service to the nation, are finding it difficult, if not impossible, to expand sufficiently to do so. Most of them are operating today largely on temporary grants for specific projects and are in serious need of firm and long-term financial support.

Top-Level Planning for Better Health

I believe it is of the utmost importance that the President and the Congress should take whatever steps may be necessary to develop the strongest possible emergency health program with primary emphasis on the prevention of disease. They should select as their advisors physicians of broad vision who are also leaders of recognized competence, training and experience in military preventive medicine and civilian public health. The fact that a doctor is a distinguished specialist in some branch of curative medicine does not of itself qualify him to play a constructive role in planning the nation's program for disease prevention. To assume that a great surgeon, a renowned dermatologist or a well known obstetrician must also possess the special skills and experience required for national planning in preventive medicine and public health is as illogical as to expect that a chemical engineer could have planned and directed the construction of the Golden Gate Bridge or the Empire State Building.

It would seem wise to establish an emergency federal department of health headed by a Secretary of Health of Cabinet status and with the above qualifications. This department could be similar to the one proposed on February 19, 1949, in the American Medical Association's 12 point program for improving the national health. The Secretary of Health should be responsible for the planning, coordination and integration of all federal health activities except those of the Armed Forces. The establishment of a strong federal department of health would facilitate the rapid mobilization of America's resources to meet the present emergency. Its establishment at Cabinet level would provide for close cooperation and joint planning with the Secretary of Defense and his policy-making health staff. That staff likewise should include not only eminent physicians and surgeons, but also recognized experts in preventive medicine and public health. This could be done by expanding the present Armed Forces Medical Policy Council. With such strong top-level leadership it will be possible to develop a closely integrated national program aimed at the more effective conservation of the health of both civilians and the Armed Forces.

And now we come to the question of cost. It is believed that our national health program, including adequate provision for the education of specialists, could be reorganized along the lines suggested at a cost which is little more than the total now being spent for public health. Certainly the additional cost would be insignificant compared with some of the enormous expenditures made by our government in recent years for programs of much less value. The final question to be decided is: Who will pay for the nation's future program of health? Will we continue to rely on the generosity of wealthy individuals for the partial support of research and education in medicine and public health? Can we expect our philanthropic foundations to continue their donations and to do a major portion of this job? Or must we look to the government to finance the nation's health program?

I shall not attempt to answer these important questions. They represent a great challenge to our new President. I am confident that he will meet this challenge as courageously, objectively and successfully as he has met every other crisis in his constructive life. I am sure that he and the Congress will receive the full support of the united professions of medicine and public health and all of America's great institutions in whatever plan they may adopt to protect the nation's health.

The Physician's Role in Preventive Medicine and Public Health

HUGH R. LEAVELL*

Harvard School of Public Health, Boston

The private practitioner provides the great bulk of preventive services to the community. When divided into five "levels of prevention" these services have greater meaning. Public health is simply organized community action for solving a more or less complex health problem. The practitioner also has an essential role in most public health work.

H. R. LEAVELL

THE physician in private practice provides the major proportion of preventive services in the United States. This is illustrated by the Academy of Pediatrics[1] survey which found the average pediatrician devoting 54 per cent of his practice to health supervision of well children. And though general practitioners were spending only 9 per cent of their professional time on preventive work for children, they provided three-fourths of the total amount of this service. Another study of preventive services for mothers and children in the Grand Rapids, Michigan, area[2] showed that private physicians supplied practically all (98 per cent) of the prenatal care, 84 per cent of the medical check-ups of babies and some 80 per cent of the diphtheria and pertussis immunizations.

Internists reported[3] spending 26 per cent of their time on various preventive measures such as immunizations, periodic health examinations and counseling, and 18 per cent on health education of patients (14 per cent in relation to treatment and 4 per cent "preventive").

Equally striking examples from other fields of medical practice might be cited to illustrate how important have preventive services become in medical practice.

Sharp distinction between prevention and treatment can be made with validity only if one takes a narrow view of prevention. Taking a broader view, an appendectomy not only treats the appendicitis but also serves to prevent peritonitis. Proper therapy of a compound fracture prevents handicapping deformity and may also prevent osteomyelitis or tetanus. Treatment of erosions or tears of the cervix may prevent cancer, and so on. Modern treatment of appendicitis, fractures or cervical lacerations undoubtedly demands suitable precautions to avoid complications such as those mentioned. It is stimulating, however, and the patient receives better care if the physician consciously considers the whole natural history of the disease process and consciously interposes preventive meas-

*Professor of Public Health Practice and Head of the Department, Harvard School of Public Health, Boston, Massachusetts.

ures to intercept the process whenever it is possible to do so.

Employment of this concept demands the broadest possible knowledge of the natural history of disease so that preventive efforts may be made at the most strategic points. For example, in a disease like rheumatic fever it is important to know that recurrences are common and likely to be precipitated by *Streptococcus* infections of the throat. Prophylactic use of antibiotics then becomes a rational preventive measure to avoid these recurrences.

Preventive measures may be applied to promote health and prevent or retard the progress of disease in various stages of its natural history at five major levels or phases: (1) promotion of health; (2) specific protection against disease or injury; (3) early diagnosis and prompt treatment; (4) limitation of disability, and (5) rehabilitation (Figure 1). Brief analysis of these levels is helpful.

Promotion of Health

Promotion of health is aimed at achieving the best state of health attainable through full application of our existing knowledge. There must be wages adequate to provide proper housing, nutrition and recreation, and health education to assure good mental health and personal hygiene. More than the mere absence of disease, we refer to what has been called positive or optimum health. There is good evidence that industrial productivity can be materially increased by health promotional methods now available if we only would use them. Obviously many community agencies in addition to physicians and the health agencies are concerned with health promotion. Research will surely uncover many new avenues of approach.

Specific Protection

This represents prevention in its strictest sense and includes many of the measures commonly thought of when the word "prevention" is used in the narrow sense. One thinks of the many immunizations against communicable disease, pasteurization of milk, purification of water, proper waste disposal, prevention of air contamination such as that which might lead to silicosis, prevention of industrial dermatitis, control of insect vectors of malaria, yellow fever, etc., control of animal vectors of disease such as trichinosis, etc. Equally important are measures to prevent accidents, which still remain in fourth place as causes of death, and measures to prevent allergic manifestations and a host of other conditions.

Early Diagnosis and Prompt Treatment

If health promotion and specific protection fail, disease may "take hold" and progress at least to the point where it may be detected by modern tools devised to permit much earlier diagnosis than was possible a few years ago. It has been conclusively demonstrated in the case of certain infectious diseases like tuberculosis, syphilis and pneumonia that prompt treatment made possible by early diagnosis is a most effective means of preventing complications, sequelae and transmission to others. It may also bring about cures in a great many cases. Evidence is increasing that early diagnosis and prompt treatment of certain long-term illnesses in the degenerative group, such as diabetes and some forms of heart disease, may be of great importance in delaying progress of the disease even though cure may not be possible at present.

Limitation of Disability

When prevention is not possible in earlier phases of the natural course of illness, wise treatment may interrupt the course and avert disability, defect or premature death. This level of prevention is often not readily distinguishable from the level of early diagnosis and prompt treatment. There is real value, however, in having both levels in mind in planning preventive work.

Rehabilitation

After the disease process becomes relatively stabilized, often it is possible to prevent complete disability and make maximum use of remaining capacity by physical and mental rehabilitation and vocational training. Poliomyelitis is an excellent example of what re-

LEVELS OF PREVENTION

FIGURE 1. The five major levels or phases at which preventive measures may be applied to promote health and prevent or retard the progress of disease in various stages of its natural history.

LEVELS

PROMOTION OF HEALTH

Aimed not at any particular disease, but at promoting better GENERAL HEALTH

2 SPECIFIC PROTECTION

BEFORE the disease process begins within the body, specific measures may be taken to prevent it.

3 EARLY DIAGNOSIS AND PROMPT TREATMENT

The disease process is now DEMONSTRABLE within the body, but still in the EARLY STAGES, often before serious damage has been done.

4 LIMITATION OF DISABILITY

Disease is now more or less ADVANCED and the object is to prevent as much defect and disability as may be possible, and to prevent premature death.

5 REHABILITATION

Disease is now relatively STATIONARY, and the object is to prevent long-term disability and dependency.

STAGE OF THE DISEASE PROCESS

RESEARCH

to learn more and more about natural history of disease process, so preventive measures may be taken at earlier and earlier LEVELS.

habilitation can do even though knowledge of the natural history of the disease does not yet permit complete control of this disease by prevention at earlier levels.

Roemer[4,5] has shown how a program of preventive medicine may be tailored to needs of the individual at different ages, concentrating on attention to the conditions most likely to be of importance at varying periods of life, for each sex and depending on the kind of work in which the individual is engaged.

In occupational medicine preventive service is of demonstrated importance, and here again it can be of most benefit if the industrial physician is fully aware of the exposures to toxic substances to which the worker may be subjected.

Perhaps the greatest obstacle to wider use of preventive services in private practice is the fact that people often are less ready to pay for them than they are for treatment of manifest illness. Gregg[6] gets at the heart of this problem in saying: "The lay public in general still thinks that good health is a matter of good luck. Whoever paid for good luck? Why, the essence of good luck is that it costs nothing—no money, no effort. So who can be surprised if preventive medicine . . . is still ignored by the vast majority of people. . . . As soon as people realize that protection against illness and provision of medical care are as rational and valuable expenditures as those for food and housing, we shall reap the harvest of our knowledge of etiology and prevention." Prepayment plans which provide comprehensive coverage, including prevention, will help solve this problem.

New problems facing the practitioner today would bewilder the horse-and-buggy doctor of yesterday. Faster transportation and communication, increasing industrialization and urbanization and smaller families have led to new patterns of practice. And instead of devoting much of his time to attending acute communicable disease cases the modern doctor must cope with a great deal of long-term and expensive illness typical of the degenerative diseases now able to establish footholds due to longer average life.

Medical care is vastly more complex and expensive, requiring a highly trained team of specialists in several professions as well as elaborate diagnostic and treatment agents and facilities such as the modern hospital. Intelligent efforts to bring greater efficiency and economy into this complicated situation are apparent in the development of group practice and in regional organization of hospitals to avoid duplication of expensive equipment and to spread high quality services to more people.

Illness among individuals is just as unpredictable and the costs are just as unequal now as they were formerly. However, progress is being made in extending prepayment plans to larger segments of the population and in increasing comprehensiveness of coverage.

The concept of the worth of the individual to society is expressed today less in charity and more in social security legislation. Greater attention is paid to the well-being of the worker, to improved housing and better educational and recreational facilities.

These changes have caused the development of complex community health and welfare services. Present day doctors must be as well informed about these community treatment facilities as they are about the medical pharmacopeia, and able to guide their patients intelligently. The situation is too complex for the average patient to face unaided.

When a health problem becomes so complex that it is solved best by organized action, then it becomes a public health problem, and the agency established to deal with it, whether voluntary or governmental, is properly called a public health agency. Thus the American Medical Association, both voluntary and governmental hospitals, the American Cancer Society and state and local health departments may all be classified as public health agencies, each providing some sort of organized community health action.

The health department ordinarily has a broader *legal* responsibility for taking cognizance of the people's health problems and trying to get something done about them than has any other public health agency or any individual practitioner. The health officer is the "family doctor" for the community and it is

his responsibility to try to bring the equation, health needs = health resources, into balance. Though his over-all responsibility is very extensive, the wise health officer knows it would be neither practical nor desirable for the health department alone to attempt to bring health needs and health resources into balance. All the services available from private practitioners and from agencies other than the health department must be focused on the community's health problems if they are to be met. The health department's contribution is relatively small in actual service, but in studying the broad health needs and seeking to find community resources to meet them, the health department makes a major contribution.

There is little doubt that preventive services now provided in such large part by private practitioners have been stimulated to a great degree by health education and demonstrations conducted by health departments and other community agencies. In addition, services provided by these agencies to lower income groups not only lead those in higher income levels to demand similar care but also provide training opportunities for students, interns and residents. The Academy of Pediatrics survey previously mentioned found only 6 per cent of the country's health supervision of children under 5 years of age being supplied in well-child conferences, operated mainly by health departments. These conferences, however, undoubtedly have had a tremendous effect on the whole field of child health supervision.

The effect of public health nurses visiting in the homes and referring patients for private medical care when they are able to afford it has also been most important in maintaining a high level of private practice.

The time has come when the wise and open-minded private practitioner will recognize that in the modern community he does not play a lone hand. When he is ready to recognize his partners in the game, he will play more effectively for his own patients and for the whole community as well. And one of his first moves will be to promote the development of local health departments headed by full time medical specialists in public health for those parts of the nation now deprived of such services.

The community health council or health-planning agency is now recognized as the best mechanism for bringing together representatives of all groups interested in health to seek solutions of community health problems. The medical profession is needed to help the health council function effectively, and those who represent the profession must be prepared to give the necessary time. Such a council has no legal means of enforcing the recommendations it reaches after careful study of community health problems. It is effective only to the extent that its membership is representative of broad community interests and influences. A number of references on the formation and activities of health councils are readily available.[7-9]

The physician who consciously makes prevention an integral part of his practice brings added meaning and purpose to his work. His patients benefit and his work brings him greater enjoyment and satisfaction. His participation in community public health activity is simply another phase of his practice of preventive medicine. In caring for his patient he practices individual preventive medicine; in taking his part in organized community preventive services he plays his role as part of the community public health team.

REFERENCES

1. American Academy of Pediatrics: Child Health Services and Pediatric Education. New York, The Commonwealth Fund, 1949.
2. Eldering, G. and Kendrick, P. L.: Measuring the extent of immunization in Grand Rapids and Kent County, Michigan. Pub. Health Rep. 67:535-540 (June) 1952.
3. Dowling, H. F. and Shakow, D.: Time spent by internists on adult health education and preventive medicine. J.A.M.A. 149:628-631 (June 14) 1952.
4. Roemer, M. I.: A program of preventive medicine for the individual. Milbank Mem. Fund Quart. 23:209-226 (July) 1945.
5. ———: Preventive services in medical practice. In Leavell, H. R. and Clark, E. G.: Textbook of Preventive Medicine. New York, McGraw-Hill & Co., 1953, chap. 10.
6. Gregg, A.: Transition in medical education. Proceedings of Conference on Preventive Medicine and Health Economics, University of Michigan School of Public Health, Ann Arbor, 1946.
7. American Medical Association Council on Medical Service and Committee on Rural Health: The Community Health Council, Its Organization, Its Functions and a Few Suggested Projects. Chicago, American Medical Association, 1949.
8. U. S. Public Health Service: Planning for Health Services; a Guide for States and Communities. Washington, Government Printing Office, 1949.
9. Lyon, Yolande: Stepping Stones to a Health Council. New York, National Health Council, 1952.

Some Current Problems in Sanitary Engineering

EDWARD W. MOORE* AND PETER C. G. ISAAC**

Harvard School of Public Health, Boston

One of the primary functions of the sanitary or public health engineer is to translate the findings of medical science into mechanisms for environmental control at minimum cost. Some problems of current interest in the exercise of this function are discussed in this paper: infant methemoglobinemia produced by high-nitrate waters, fluoride in water supplies as a means of influencing tooth formation, and recent developments in the technics of water and sewage disinfection.

E. W. MOORE

P. C. G. ISAAC

THE field of sanitary engineering originated through the efforts of men with many different kinds of training—by no means exclusively engineers—to apply engineering methods toward the creation of an environment that shall be both healthful and agreeable. Since the word "engineering" implies getting the maximum result per dollar of expenditure, the duty of the sanitary engineer is to offer solutions to problems of environment that shall be the most economical that application of current science permits. As an example, one may refer to the present interest in removing from sea water or brackish water the dissolved solids which make these waters unfit for human consumption. It is possible to do this by distillation, but the product is relatively expensive and the process can be considered only under special conditions where any other solution of the problem would cost much more—for example, on small islands during wartime. New applications of the process of ion exchange, in the form of selectively permeable ion exchange membranes devised by chemists, offer the possibility of a more economical conversion of salt water to fresh. It will be the duty of the sanitary engineer to investigate this process with respect to water quality and cost of water produced, and to recommend its application where indicated.

Perhaps the most important duty of the sanitary engineer is to be alert to the current thinking of the medical scientist, in order to be prepared to offer engineering solutions to problems of disease prevention when, and only when, medical science has indicated that engineering methods might be of value. At the same time, the sanitary engineer scrupulously must avoid appearing to try to set himself up as an authority on medical science; such behavior will greatly impair cooperation between the two groups.

*Associate Professor of Sanitary Chemistry, Division of Applied Science and School of Public Health, Harvard University, Boston, Massachusetts.

**Lecturer in Civil Engineering, King's College, Newcastle upon Tyne, England. Graduate Student in Applied Science, Harvard University, Boston, Massachusetts, 1951-1952.

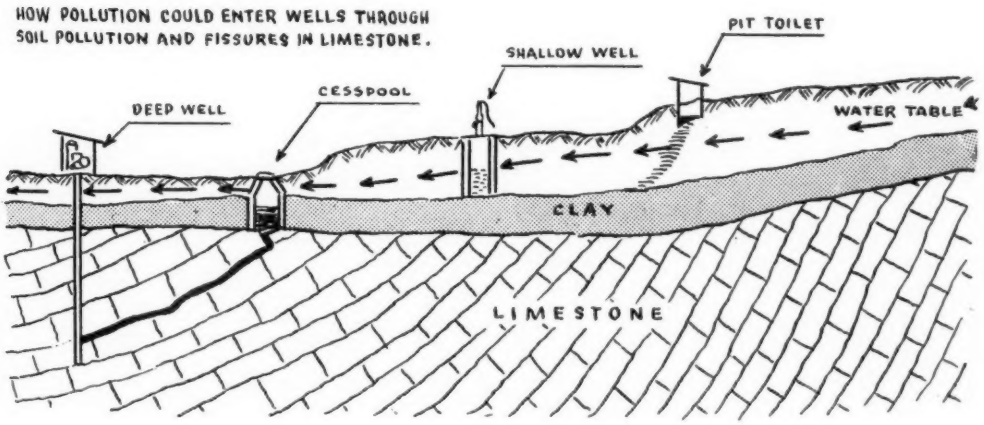
It is the purpose of this paper to discuss a few of the current problems which are interesting medical scientists in the public health field and which are, or may become, subjects for engineering applications. These problems are, respectively, that of infant methemoglobinemia due to high nitrate in well water, the favorable and adverse effects of fluorine in water on teeth, and the possible implication of the water and sewage cycle in the transmission of certain diseases whose epidemiology is as yet uncertain. In addition, a brief review is given of the current thought on the disinfection of water and sewage, a technic which is an outstanding example of the application of engineering methods to the prevention of zymotic disease.

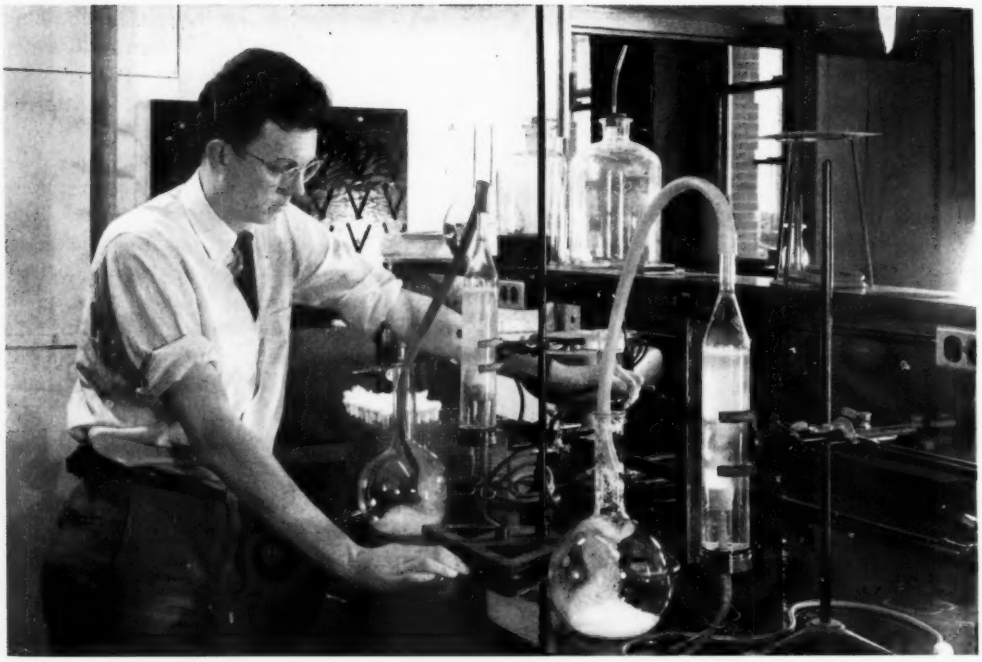
Nitrate Methemoglobinemia

Comly[1] in 1945 was the first to offer definite proof of the existence of a type of methemoglobinemia in infants produced by the use of water high in nitrates in making up feeding formulas. The condition developed some weeks after birth and often disappeared when the water supply was changed. It was also produced experimentally by feeding formulas containing substantial amounts of nitrate. Bosch and others[2] have discussed the etiology of some 139 cases, including 14 deaths, reported in Minnesota between 1947 and 1950. In all cases the infants had been bottle-fed on a formula calling for dilution with water. The age at onset of symptoms in 90 per cent of the cases was under 2 months. The time of exposure to the suspected water is known for 94 patients; half of these were exposed for between one and three weeks before symptoms were reported.

In 8 cases determinations were made of methemoglobin in the blood; this varied from 0.355 gm. per hundred milliliters for an infant fed on well water containing 66 parts per million (ppm) of nitrate nitrogen to 4.95 gm. per hundred milliliters for one fed on water containing 500 ppm.

In all the cases the water was drawn from private wells, most of which proved to be shallow wells in rural areas, unsatisfactory as to construction and location. None of these wells contained less than 10 ppm of nitrate nitrogen at the time of analysis, and only two contained less than 20 ppm. The average concentration in the suspected wells was 102 ppm. Bosch and his co-workers recommend that water containing more than 10 ppm should not be given to infants. Others have suggested a limit of 20 ppm. It is obvious that sanitary engineers must assume a large share of responsibility in the control of this condition, even though no public water supply has ever been involved. A few of the mat-





NEW WATER-PURIFICATION PROCESS—A possible new process of water purification involving flotation of bacteria and impurities with quaternary ammonium compounds has been developed in the Department of Sanitary Engineering, Harvard School of Public Health, by Associate Professor Edward W. Moore and Mr. George Bryant (shown here), Research Associate. The process may be a substitute for purification by filtration, particularly with reference to field water purification by the Armed Forces.

ters now under investigation are the development of rapid field tests for nitrates, studies of the large, seasonal variations in nitrate content of wells, and programs for improvement of unsatisfactory wells. At present there seems little possibility of a cheap and simple process to remove nitrates from water, but even this approach is not being neglected.

Fluorine and Teeth

It has become evident that the fluoride content of the drinking water consumed by children during the period of tooth formation exercises a marked influence on tooth structure. The first condition to be noticed was that of endemic dental fluorosis, popularly known as mottled enamel. It was first described by Eager in 1901 among immigrants from Pozzuoli, Italy, and subsequent investigations showed it to be endemic in many parts of the world. The teeth lose their customary luster and become chalky white; they later develop disfiguring patches of yellow mottling, or dark stains. Once established, the defects are permanent. The condition is always associated with the consumption during the period of permanent tooth formation of waters containing unusually large amounts of fluoride. Broadly speaking, the threshold level appears to be 0.8 to 1.0 ppm of fluorine, as fluoride. The incidence and severity of dental fluorosis vary with concentration: At about 1 ppm, 10 per cent of the children will show definite signs of fluorosis; at 2 ppm the incidence is about 50 per cent, and at 5 ppm the condition appears in substantially all of the consumers and is severe in some 20 per cent of them.[3] The condition has also been produced experimentally by providing white rats with drinking water containing sodium fluoride.[4]

Research by sanitary chemists and engineers has developed a number of methods by which the fluoride content of water may be reduced.[5] The one most widely used at present is applicable to the hard, fluoride-bearing waters of the Midwest, and consists of softening the water after adding magnesium salts. The fluoride is removed along with magnesium hydroxide in the softening process. A method applicable to soft waters is a reversible ion exchange process whereby the fluoride is taken up by granules of processed tricalcium phosphate, which are then regenerated with a caustic soda solution. However, many communities are still forced to use water supplies which are high in fluoride, and it is evident that further studies are necessary to reduce the cost of fluoride removal. There has been an unfortunate decline in interest in this problem because of the great publicity recently given to the opposite side of the question, namely, the addition of fluoride to waters deficient in natural fluorides.

As early as 1916, workers in this country had noted that the inhabitants of Colorado Springs, an area of endemic dental fluorosis served with water containing 2.6 ppm of fluoride, had a dental caries experience markedly lower than the national average.[6] Workers in many other countries have also noted this inverse relationship between fluorosis and caries. For example, Weaver[7] compared the teeth of groups of 500 5 year olds and 500 12 year olds in the communities of North Shields and South Shields (Great Britain), the water supplies of which contained, respectively, 0.25 and 1.4 ppm of fluoride. The over-all incidence of caries in South Shields children was only 56 per cent of that in North Shields. There is still disagreement about the permanency of the protection afforded by fluorides; Weaver concluded that the fluoride served merely to postpone maximum incidence of caries for about five years, but the Colorado Springs studies indicated protection up to at least the fortieth year of life.

A number of experiments on the controlled addition of sodium fluoride to water supplies were begun by the United States Public Health Service about 1945, using pairs of similar communities, one of which received fluoridated water. As the results of these controlled experiments accumulate, the inhibition of caries achieved by fluoridation tends to approach the 50 to 65 per cent reduction found by Dean[8] in his comparison between communities having 1 to 1.5 ppm natural fluoride in their water supplies and a similar group having very low natural fluoride. Hence, there appears to be no difference in effect between artificially added fluoride and that present naturally.

The question has now reached the public press, and there is much agitation both for and against fluoridation. As of mid-1951, there were 82 supplies receiving fluoride addition and serving 1,700,000 people, and approval had been given for fluoridation of 95 other supplies serving 6,000,000 people. It is not for the sanitary engineer to involve himself in a controversy over the merits of fluoridation per se; this is a matter for decision by medical scientists. The sanitary engineer's contribution has been the development of easy dosing methods, the imposition of rigid control over the handling of a toxic material—sodium fluoride—and, particularly, close control of the amount added. It appears that the approved dosage of 1 ppm in northern communities should be reduced to 0.7 ppm in southern communities, largely because of the greater amount of water consumed per individual. Other compounds, less toxic than sodium fluoride but equally effective, have been introduced. Sodium fluosilicate or fluosilic acid may eventually replace sodium fluoride as the additive; in present markets the fluosilicate is considerably less expensive.

The opponents of fluoridation truthfully adduce that not more than 0.04 per cent of the total supply of fluoridated water is consumed by children in the age group in which it is effective. The proponents reply that the cost is so small—15 cents or less per capita per year—that this does not matter. The opponents point to the abandonment of the once popular iodization of water for the prevention of goiter, and suggest some other vehicle, such as milk, for fluoridation, or the topical appli-

cation of fluoride. The sanitary engineer can only stand ready to see that if fluoridation is applied, it shall be applied under proper control and in the most economical way.

Poliomyelitis Virus in Sewage and Water

Despite an enormous amount of research, medical scientists do not appear as yet to agree on the mode or modes of transmission of poliomyelitis. The sewage-polluted water supply has been suggested as a possibility, although this is discounted by most medical scientists. It is, however, worth while to review some of the present knowledge about the occurrence of the virus in sewage and polluted water, and what little is known about the response of the virus to water purification technics.

It has been shown by workers in this country and in South Africa that poliomyelitis virus can be recovered from raw sewage emanating both from hospitals treating patients with the disease and from mains in residential areas where no paralytic cases are known but where the disease is present in other parts of the city.[9] The virus can also be isolated from the raw sewage of a community for a short time after an epidemic, and it may occasionally be found in a treated sewage effluent. Many attempts have also been made to recover virus from samples of suspected water, but the results have been either doubtful or clearly negative. Since one cannot be sure that the methods used to recover virus from water are adequate, it is well to consider briefly what is known about the effect of water treatment processes on the virus.

Under laboratory conditions water has been contaminated by nerve tissue suspensions of virus and treated variously by coagulation and sedimentation, sand filtration, adsorption on activated carbon, and storage and aeration. Individually, each treatment failed to remove the virus completely from the heavily contaminated water. It should be noted that the same thing would be observed in samples equally heavily contaminated with bacteria, which can readily be entirely removed by a complete water treatment plant under natural conditions of contamination. Work currently being carried on by one of the authors (P. C. G. I.) indicates very substantial removal of bacteriophage suspensions by coagulation with alum followed by sedimentation.

Maxcy[9] concludes that 0.2 to 0.3 ppm of free available chlorine would be sufficient to inactivate the quantities of poliomyelitis virus that would be likely to be present in a potable water. Many water plants maintain chlorine residuals of this order as routine procedure. It is very likely that a complete, modern water treatment plant with postchlorination to a substantial free chlorine residual could be relied on to remove or inactivate a fairly heavy concentration of virus. Maxcy definitely states that "there is on record not a single explosive outbreak of this disease which has been conclusively shown to be due to the simultaneous exposure of a group of people to a common water supply."

Histoplasmosis

Another disease for which the mode of transmission appears as yet uncertain is histoplasmosis. There has been some interest in water as a possible vehicle for transmission, and the question is now under study. The Division of Sanitation of the Kansas State Board of Health[10] has carried out laboratory experiments which show that the yeastlike phase of *Histoplasma* survives in sterile tap water for 95 days at 4°, 20° and 25° C., for 62 days at 34° C. and for 51 days at 37° C. There was no survival at 45° C. At temperatures below 34° C., the mycelial phase of the organism was viable after 30 days. Preliminary tests with a model rapid sand filter operated at normal water purification rates indicated that a few of the chlamydospores penetrated up to 12 inches of sand. The work is still in progress; its significance to epidemiology of histoplasmosis remains to be seen.

Disinfection of Water

Final treatment of the water by disinfection

is almost universal in systems of any size in this country and Britain. By far the most common disinfecting agent is chlorine, used either as liquid chlorine in pressure cylinders or in the form of sodium or calcium hypochlorite. Other disinfecting agents which have been suggested are ozone, ionic silver, ultraviolet light, heat and ultrasonic vibrations, but with all of these, practical difficulties are encountered in application and none are used in place of chlorine except under very special conditions. Ammonia is sometimes used in conjunction with chlorine; it combines to form chloramines, which have diminished disinfecting action but also have less tendency to react with substances present in the water to form compounds of objectionable taste and odor. A new development is the use of chlorine dioxide in conjunction with chlorine; the dioxide tends to oxidize and destroy substances which produce tastes and odors. It is produced by reacting chlorine with a solution of sodium chlorite.

In the past, chlorination had been regarded as a comparatively simple process. Sufficient chlorine was added to produce, after a short contact period, a stated residual chlorine content as determined by the ortho-tolidine test. At intervals, the water was tested to determine whether it was bacteriologically satisfactory. Recent research has shown that the action of chlorine in natural waters is so complex that simple control of residuals is inadequate. It is known that the added chlorine is at once transformed to hypochlorous acid ($HOCl$) and hypochlorite ion (OCl^-); the relative proportions of these depend on the *p*H value of the water.[11] These compounds then react with ammonia and other substances present in the water to form chloramines and other chlorine substitution products of varying disinfecting activity; the rates of these reactions are also widely variable. It is possible to add sufficient chlorine to carry the process through the complete oxidation of the chlorine-reactive substances, and at this point the chlorine residual in the water again consists entirely of $HOCl$ and OCl^-. The water is then said to have a "free chlorine residual" as opposed to the "combined chlorine residual" of the chlorine existing as chloramines and other active compounds.

A free chlorine residual has a much more rapid disinfecting effect than the chloramines at comparable levels of concentration. Moreover, among the three forms of simple chloramines that may exist, namely, monochloramine (NH_2Cl), dichloramine ($NHCl_2$) and nitrogen trichloride (NCl_3), there are considerable differences in disinfecting efficiency; dichloramine appears to be the most powerful.[12] The disinfecting power of the free chlorine residual itself is greatly dependent on the *p*H value of the water between *p*H 6 and 11; an increase in *p*H value greatly decreases the disinfecting efficiency because of the shift in the chemical equilibrium between hypochlorous acid ($HOCl$), a powerful disinfectant, and hypochlorite ion (OCl^-), a much weaker one. Fair and co-workers[11] have shown that experimental disinfection rates may be predicted by computing this equilibrium distribution from the ionization constant of hypochlorous acid and the *p*H of the water.

Temperature is also a factor; increased temperature increases bactericidal efficiency. Disinfection rates are approximately logarithmic. For any one disinfecting compound, for example $HClO$, the time required for a given percentage of kill bears an approximately reciprocal relationship to the concentration of disinfectant.

Enough has been said to show that chlorination is by no means the simple business that it was once believed to be. Adequate control requires a thorough knowledge of the chemical composition of the water to be treated, and of the probable changes in this water. Chlorination to a definite free residual simplifies the problem somewhat, and is advocated by many. However, some improvement in methods for differentiating free and combined residuals is necessary. Present practice, based on studies by Butterfield[13] and many other workers, and on general experience, considers that free chlorine residuals of 0.2 to 0.8 ppm after 10 minutes' contact, or combined chlorine residuals of 1.0 to 1.8 ppm after 60 minutes' contact, can be depended on for adequate disinfection.

The majority of enteric pathogens appear to be less resistant to disinfection by chlorine than is *Escherichia coli*. Since this organism is excreted in much greater quantity than the pathogens, and remains viable in water somewhat longer, it is a useful index of fecal pollution. The one objection is the length of time required to detect it; a really rapid test for fecal pollution of water would be of untold value. The problem is earnestly recommended for attention by the medical scientist; it now requires several hours to determine whether a water supply has become polluted. However, despite this frightening lag in information, the fact that water-borne diseases are now most uncommon in countries with good piped water supplies indicates that modern methods of water disinfection are adequate to eliminate the majority of pathogens. This is not a matter of chance, but is achieved only at the cost of constant vigilance on the part of a competent engineering supervisory staff working with modern plant and equipment.

Disinfection of Sewage Effluents

Another way of eliminating pathogens from water is, so to speak, at the source. The normal processes of sewage treatment greatly reduce the bacterial population but cannot be expected to produce anything approaching a sterile effluent. Disinfection of the effluent by means of chlorine is often practiced. The principles of sewage chlorination are little different from those of chlorination of water, except that the achievement of a free chlorine residual is impossible except at tremendous dosage and reliance is placed entirely on chloramines formed from the ammonia of the sewage. Much remains to be learned about the relationships of dosage, contact time and percentage kill of organisms. Another problem is the comparatively recently noted phenomenon of "after-growth"; a chlorinated sewage sometimes shows a great reduction in bacterial population at first, but on being held for a day or two undergoes an increase in bacterial numbers that may equal or surpass the original population.[14] This is thought to be due to the complete destruction by chlorine of the predators that generally hold down bacterial populations. The real importance of this phenomenon for practical sewage chlorination can be determined only by learning whether any of the potential pathogens can undergo this increase. As yet this has not been studied, and the problem is somewhat difficult to attack in a manner which will supply answers applicable to practical sewage chlorination.

In conclusion, we feel that this brief review will have accomplished its main purpose if it has in any small measure brought forward the community of interest between the medical scientist and the sanitary engineer or, if one prefers, the public health engineer. We have confined ourselves to problems in water and sewage treatment only because of limitation of space and because these are the fields we know best. We have had to omit other great, and perhaps even more important, areas of common interest such as food and milk control, control of insect-borne disease or the new problems of control of residual radioactivity. The opportunities for cooperation between medical science and engineering are literally without limit.

REFERENCES

1. Comly, H. H.: Cyanosis in infants caused by nitrates in well water. J.A.M.A. 129:112, 1945.
2. Bosch, H. M. and others: Methemoglobinemia and Minnesota well supplies. J. Am. Water Works A. 42:161, 1950.
3. Taylor, E. W.: The Examination of Water and Water Supplies. Ed. 6. London, J. & A. Churchill, Ltd., 1949.
4. Sebrell, W. H. and others: Changes in the teeth of white rats produced by water containing sodium fluoride. Pub. Health Rep. 48:437, 1933.
5. Maier, F. T.: Methods of removing fluorides from water. Am. J. Pub. Health 37:1559, 1947.
6. Russell, A. L. and Elvove, E.: A study of the fluoride-dental caries relationship in an adult population. Pub. Health Rep. 66:1389, 1951.
7. Weaver, R.: Fluorosis and dental caries on Tyneside. Brit. Dent. J. 76:29-40 (January 21) 1944.
8. Dean, H. T.: Fluorine in dental caries control. Postgrad. Med. 5:361-367 (May) 1949.
9. Maxcy, K. F.: Supposed involvement of water supplies in poliomyelitis transmission. J. Am. Water Works A. 41:696, 1949.
10. Metzler, D. F.: An Investigation of the Occurrence, Distribution, and Characteristics of Various Types of Fungi in Water Supplies. Progress Report, Kansas State Board of Health, 1951.
11. Fair, G. M. and others: The behavior of chlorine as a water disinfectant. J. Am. Water Works A. 40:1051, 1948.
12. Palin, A. T.: Chemical aspects of chlorination. J. Inst. Water Eng. (Brit.) 4:565, 1950.
13. Butterfield, C. T.: Bactericidal properties of chloramines and free chlorine in water. Pub. Health Rep. 63:934, 1948.
14. Department of Scientific and Industrial Research: Water Pollution Research, 1948. London, H. M. Stationery Office, 1949.

Physiology and Environment

JAMES L. WHITTENBERGER*

Harvard School of Public Health, Boston

The prevention and control of many diseases and disabilities require a knowledge of the effects of the social and physical environment on man. These influences are very complex in our modern industrial society and are likely to become even more so. Some of the simpler and relatively well known problems include the effects of atmospheric contamination and environmental heat stress. Solution of such problems involves the cooperation of physiologists with epidemiologists and industrial hygiene engineers in a combined effort.

J. L. WHITTENBERGER

An essay on the interrelationships of physiology, environment and public health requires a selection of topics, since physiologic science in the broad definition includes the study of the functional aspects of all interrelationships between man and his environment. By evolution in postgraduate public health education, physiology has become of specific importance in the understanding of human performance in particular industrial or military environments—for instance, the case in which man is required to live and work under conditions of high temperature and humidity. This interpretation of physiology and environment will be the basis of the first portion of this discussion, with a broader perspective to be outlined later.

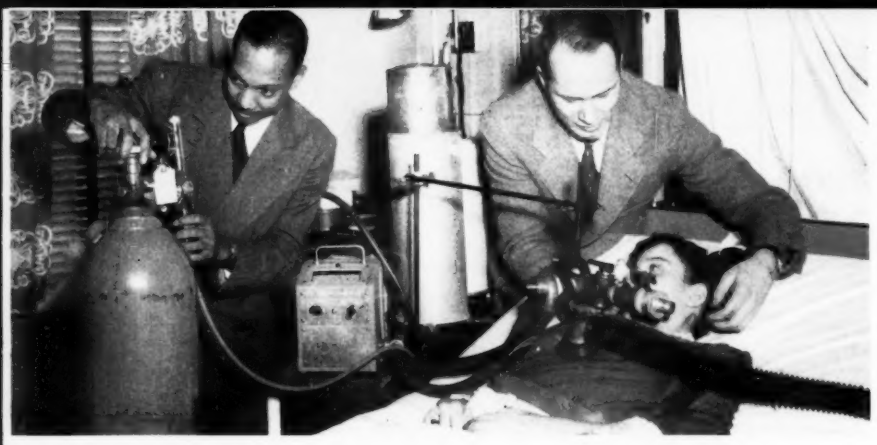
Physiology in Occupational and Other Artificial Environments

A logical division can be made between the influences of the natural or the outdoor environment and special types of surroundings introduced by fabrication of closed shelters, manufacturing processes and contamination of the atmosphere by particles, vapors and gases. The latter types of artificial environment are presenting increasingly complex and serious problems in many American industrial and residential areas at present.

Atmospheric contamination—The primitive hunter or farmer was not free of environmental hazards in the form of the elements of weather, but his physiologic adjustments were largely of biologic nature compared with the complex requirements of modern agriculture. Although mechanization of agriculture has greatly reduced the amount of manual labor, the development of a host of new and dangerous insecticides and methods for chemical treatment of the soil has created the need for an understanding of the physiologic action of these agents and for the physiologic evaluation of work performance in the presence of equipment worn to protect the lungs and body from them.

The physiologic action of inhaled dusts, fumes and gases is of great significance in many occupations. Of the possible portals of entry of atmospheric contaminants, the skin provides excellent protection against most,

*Professor of Physiology and Head of the Department, Harvard School of Public Health, Boston, Massachusetts.



FACULTY-STUDENT RESEARCH—Dr. Benjamin G. Ferris, Jr. (right), Associate in Physiology at the Harvard School of Public Health and Director of Medical Research and Care at the Mary MacArthur Memorial Respirator Center in Wellesley, Massachusetts, and Dr. C. Warren Smith, a former student at the School from the Virgin Islands and now a resident physician at Bellevue Hospital, take pulmonary subdivisions on a patient in chest respirator.

since relatively little surface is involved and permeability rates are generally so low that systemic effects do not occur. This is not to say that chemicals on the skin do not produce troublesome and sometimes serious local effects; numerically, skin ailments constitute a large fraction of industrial medical practice.

From the point of view of systemic effects, the respiratory and alimentary systems are the significant avenues of absorption of toxic substances. Of these, the digestive system probably has been greatly overrated.

The lungs, however, provide an enormous surface of almost direct contact between circulating blood and the air we breathe; it has been estimated that the total alveolar-capillary surface area of an adult human being is of the order of magnitude of 100 square meters, equivalent approximately to the area of a singles tennis court. This tremendous capillary surface is exposed to a gas mixture which is precisely controlled in composition by the finely regulated nervous and chemical control of breathing. The pulmonary capillary blood comes into virtually complete equilibrium with this gas mixture, obeying the laws of diffusion and solubility. This statement applies not only to the physiologically important gases, carbon dioxide and oxygen, but also to other constituents of the gas phase such as nitrogen, and in special circumstances carbon monoxide, ether, alcohol, lead fumes or other contaminant of the inspired mixture.

The respiratory system is equipped with a number of mechanisms for protecting the alveolar surfaces and blood stream from harmful agents in the inspired air. The convoluted and moist surfaces of the upper passages act as an effective filter against large particulates and many reactive chemicals. Secretion of surface glands, ciliary action, coughing, and reflex bronchoconstriction are other aspects of an efficient defense system. The intense bronchoconstriction following inhalation of many foreign materials may protect the alveoli even against gases but, if too severe, the bronchospasm itself may be harmful to the organism.

The prevention and control of pulmonary injury in industry require the combined efforts of industrial hygiene engineers, physicians and physiologists. The engineer eliminates or controls the hazard as much as he can by ventilation and other "tricks of the trade." If an environmental hazard cannot be eliminated, the extent of potential injury must be assessed. Since the ventilation rate of the lungs is directly related to the total body metabolic rate, there is a close correlation between the degree of physical exercise and the effects of a given environmental exposure. The pulmonary ventilation rate is seldom sustained at a rate as high as five times the rate at rest. Thus a given toxic atmosphere would be, at most, five times as harmful during moderately hard work as during rest. This type of relationship is well known in the case of carbon monoxide.[1]

If an environmental hazard cannot be adequately controlled by engineering methods, and if men must work in such environments, individual protective measures may be resorted to. The simplest of these are dust masks or gas masks which protect the eyes and/or respiratory passages by the interposi-

tion of chemical and particulate filter materials. Unless made so large as to be inconveniently bulky, such filters constitute a significant resistance to breathing. The result is not only annoyance to the wearer but also excessive respiratory work requirements leading readily to fatigue, especially during hard physical labor. Masks also reduce efficiency in general by interference with vision and speech transmission. Most workers prefer to expose themselves to hazards rather than to wear the protective equipment. This problem will become of utmost importance as more and more workers are engaged in military and industrial operations using nuclear energy.

Atmospheric deficiencies—Although atmospheric pollution is a major problem because of the numbers of people involved, another abnormality of the atmosphere is of considerable physiologic interest and is one which leads to a number of unnecessary deaths every year in the United States. In a typical instance, a worker enters a previously closed space such as a large air-tight storage chamber, and shortly falls unconscious. Other workers rush to the rescue, sometimes wearing gas masks, and before the episode is over, 3 or 4 men may succumb. In newspaper accounts the deaths are often attributed to "sewer gas." Actually, though the composition of gases in different incidents varies widely, the common denominator causing death is usually a severe lack of oxygen in the gas mixture. Atmospheres containing essentially no oxygen will cause unconsciousness in less than 30 seconds and death in three to five minutes. Obviously, gas masks are of no value in these instances because they can filter out only what is in the inspired gas; they cannot add oxygen to what passes through. Only some form of breathing apparatus which includes a source of oxygen would be useful in these circumstances.

A form of atmospheric pollution physiologically similar to oxygen deficiency is contamination of the air with carbon monoxide. The affinity of this gas for hemoglobin has the effect of blocking the ability of hemoglobin to transport oxygen. If the oxygen-carrying capacity of hemoglobin is sufficiently impaired, the result is the same type of respiratory and circulatory failure as occurs in any form of severe anoxia.

The problems involved in the preservation of lives threatened by acute oxygen lack have always interested physiologists. Regardless of whether the emergency is due to carbon monoxide or to some other cause the prime need is for immediate restoration of ventilation of the lungs—preferably with an oxygen-enriched atmosphere. Until recently the physiologic evaluation of both manual and mechanical methods of artificial respiration has not been very satisfactory. Although the Schafer prone pressure maneuver has been the standard manual method for half a century in the English-speaking world, there has been only one vigorous report of its lack of effectiveness.[2] Stimulated by military interest, a number of physiologic laboratories have in the past two years obtained conclusive evidence that other methods having an active inspiration in addition to an active expiration are superior to the Schafer maneuver.[3,4] The new methods have been adopted and are rapidly being taught to the public, the military services and others.

Accidents, fatigue and selection—The military services and industry have recognized the importance of the relationships between human performance and the working environment; this complex field has sometimes been called "human engineering" and engages the cooperation of psychologists, safety engineers, instrument designers, anthropologists, physiologists and others. It is generally acknowledged that people vary in muscular power,

neuromuscular coordination, endurance, skill, enthusiasm and a host of other functions and attitudes. It is also agreed that these innate variables are influenced by attributes of the physical environment (light, temperature, humidity, noise, etc.) and by the temper of the social milieu. There is evidence, in fact, that the qualities and interactions of the social environment are usually of far more significance than the properties of the physical environment.[5] The practical nature of problems in this field is revealed by their importance in terms of accomplishment of objectives, work output, absenteeism, fatigue and accident rates, to mention a few.

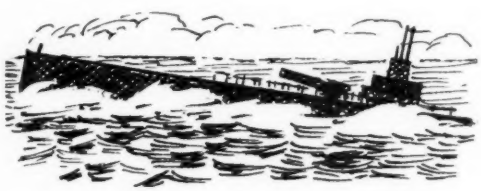
The general purpose of study in this field is to determine more precisely the influence of given environmental conditions on human performance and well-being (mental as well as physical); to provide criteria for the alteration of environmental conditions where betterment is possible (working space and instrument design, lighting, air conditioning, etc.), and to develop methods of test which will permit the selection of individuals best suited by nature for work of a certain type or under specified environmental conditions. For example, people vary in their tolerance for the hot and humid conditions which prevail in some deep mines. A heat-tolerance test based on physiologic measurements under simulated conditions would result in significant savings to an industry having this problem.

Military Environmental Problems

As the scope of political and military action has expanded to include all points on the surface of the earth, the military, at least, have been compelled to face a new spectrum of environments in which man is expected to live and to fight. These new environments include not only the whole range of climatic extremes but also the special environmental hazards of high altitude flight, submarine navigation and operation of vehicles in which the features of comfort must be sacrificed to increased fire power and protective equipment.

Aviation physiology—With the rapid progress of aviation engineering in the past decade, new physiologic problems have been created as rapidly as old ones have been solved. The basic problem of impairment due to oxygen lack was relatively easy to correct up to altitudes around 45,000 feet by enrichment of inspired air with oxygen. Above that altitude the irreducible sum of partial pressures of water vapor and carbon dioxide left no room for an adequate amount of oxygen, even though pure oxygen was breathed. The only answer to the question of oxygen supply at the higher altitudes and to the problem of vaporization of body fluids was the pressurization of a chamber surrounding the man so that he was, in effect, living at a lower altitude. This compartmentation of an artificial environment has solved some but not all of the difficulties of high altitude adventure. There is space here to list only a few of the old and a few of the new problems which occupy the efforts of physiologists as the engineers attempt to penetrate the outermost reaches of the earth's atmosphere and beyond: the circulatory effects of acceleration, aeroembolism, explosive decompression, cosmic irradiation, effects of supersonic vibrations, and the gravity-free state. The answers to some of these fascinating questions must await another day.

Submarine physiology—Underwater operations, whether in peace or in war, provide other examples of "encapsulated" environments. A true submarine can be defined as a vessel capable of submerged operation for an indefinite period of time. This means that a



"steady state" must be established for the biologic functions of the crew and the metabolic activity of the engines; contact with the normal atmosphere at sea level is exchanged for a marine environment incapable of handling the normal exchange of oxygen and carbon dioxide. The limited volume of air trapped when the submarine submerges is then subject to continuous withdrawal of oxygen and continuous contamination with carbon dioxide, water vapor, exhaust gases and other materials from crew and engines. Ordinary engines could not tolerate these conditions for long, and men are faced with two possibilities: Oxygen can be added and the air chemically purified, or the men can adapt physiologically to the high carbon dioxide-low oxygen environment. Ideally the latter course would be avoided, but for practical reasons it is important to know how much carbon dioxide in the air is compatible with good health and performance. The same question will be asked if living in air-tight rooms and air-raid shelters should become a part of our national life.

Carbon dioxide tolerance is only one of several problems which confront man trying to live and work or fight at hydrostatic pressures in excess of one atmosphere. A partial list of other well recognized categories includes oxygen toxicity, the "bends," nitrogen narcosis and lung rupture during underwater escape. The submariner not only must contend with this exceptionally complex physical environment but also is exposed at close quarters to the biologic and social environment of his mates. The submarine community presents unusual opportunities for the epidemiologist and the psychologist as well as the physiologist.

Physiology and the Total Environment

In relation to the increasing recognition of environment as an essential factor in the balance between a host population and an agent of disease, one might inquire where the discipline of physiology fits into the pattern of thinking which constitutes the ecologic approach to human health and disease. The answer can be made at two levels of inquiry, one pertaining to the individual interactions with environment, the other having to do with long-range community adaptations to an environment. A single member of a submarine crew reacts to the conditions of temperature, humidity, vibration, overcrowding, contagion and monotony, and in turn makes a personal contribution to several of these components of the surroundings. The reactions of the individual modify his relationships to the group, and thus some portions of group behavior are affected by the environment. Eventually the group would achieve a balance, an equilibrium of interpersonal relations, a harmonious host-parasite relationship, and a state of acclimatization to the specific levels of temperature, humidity, etc. However, such a group can be successful only in terms of accomplishment of a military objective; the inherent discomforts in the situation must be offset by high motivation and would never be tolerated by a normal society.

A somewhat similar parallel can be drawn from attempts of European natives to live at high altitudes in South America. Motivated by the rewards of conquest, the Spanish invaders lived more or less successfully in the high Andes of Bolivia and Peru, but not for 50 years was a living white baby born at these altitudes. In other words, individual human beings can survive indefinitely near the limiting range of environmental variations, but survival of the race requires more optimal conditions. Effective development of modern industrial societies requires even narrower limits in the physical environment. If these limits are not met by nature, attempts are then made to meet the demands of comfort by man-made environments. In many of these attempts the physiologist is a member of the team of public health scientists.

REFERENCES

1. Forbes, W. H., Sargent, F. and Roughton, F. J. W.: The rate of carbon monoxide uptake by normal men. Am. J. Physiol. 143:594-608, 1945.
2. Comroe, J. H., Jr. and Dripps, R. D.: Artificial respiration. J.A.M.A. 130:381-383, 1946.
3. Gordon, A. S., Sadove, M. S., Raymon, F. and Ivy, A. C.: Critical survey of manual artificial respiration. J.A.M.A. 147:1444, 1951.
4. Whittenberger, J. L. and Sarnoff, S. J.: Physiologic principles in the treatment of respiratory failure. M. Clin. North America 34:1-28, 1950.
5. Mayo, E.: The Human Problems of an Industrial Civilization. New York, The Macmillan Company, 1933, p. 194.

Nutritional Research in Public Health

FREDRICK J. STARE AND THE STAFF OF THE DEPARTMENT OF NUTRITION

Harvard School of Public Health, Boston

Nutritional research in public health actually reaches into all phases of public health. All we have done here is to refer briefly to some of the research activities of this department. Man must be fed in addition to being sheltered from the elements. The problem of feeding is one not only of agriculture but also of health, because the basic reason for food is to nourish the body. Wherever there are living cells there are problems of nutrition. Nutrition is really the basic problem of all health.

F. J. STARE

NUTRITION is an important consideration in every aspect of health and at all stages of life, for in its broadest sense it is essential to the growth, function, maintenance and repair of body cells. In the United States today, prevention, control and treatment of many of the common infectious diseases are well in hand and the importance of good water supplies and sanitation is appreciated; this leaves nutrition as the most important environmental factor affecting health. This statement does not refer to the classic deficiency diseases. Rather, it refers to the role of nutrition in the genesis and therapy of obesity, arteriosclerosis, hypertension, tooth decay, anemia and cancer. The potentialities of antinutrients in the treatment of disease, particularly the antivitamins of folic acid, pantothenic acid and riboflavin, are also very great.

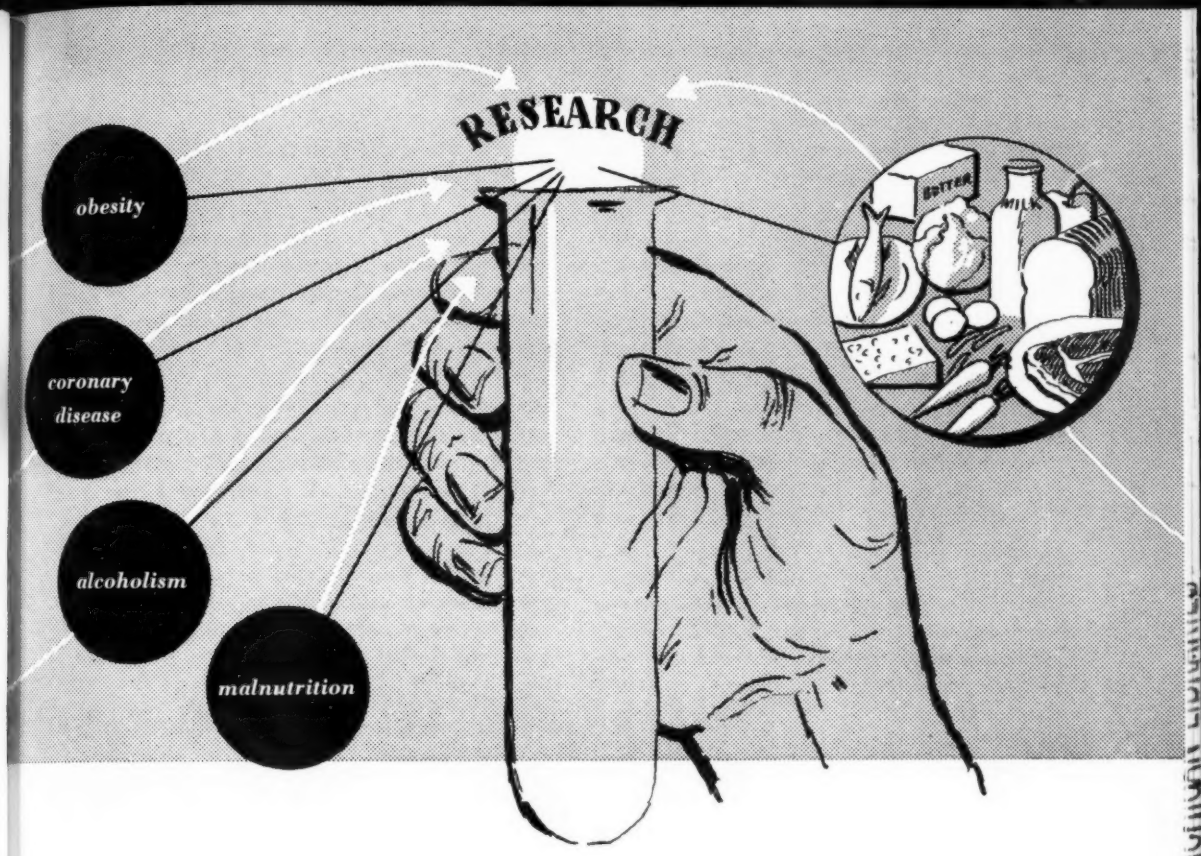
Nutrition is concerned with food and the ingredients of food known as nutrients, what these nutrients do and why we need them. It is important in public health practice to differentiate between nutrition and the usual concept of food in public health activities. At present the latter is largely confined to problems of sanitation such as food handling, refrigeration and contamination—in other words, making available clean, wholesome food. This is important, but it is not nutrition. Nutrition is the science of food and its relation to health, the effect of the ingredients of food (nutrients)—their absence or presence—on health.

Good nutrition means good, wholesome food—meat, fish, milk, eggs, fruits, vegetables, enriched and whole grain breads and cereals—consumed in variety. Variety in food consumption and consistent use of protective foods, plus maintenance of desirable weight, are probably the most fundamental practical rules for the maintenance of a good nutritional state. The influence of nutrition on the course of an illness is often of tremendous importance, but more important is the protection of body functions at high levels of health on a life span basis. One major aim of every health worker, yes, of every citizen, should be to encourage good nutrition.

Research

Our discussion of specific nutritional re-

*Professor of Nutrition and Head of the Department, Harvard School of Public Health, Boston, Massachusetts.



search in public health will be confined to some of the problems currently being studied in this department. Because of the limitations of space, many of the projects will be referred to merely in a sentence or two, but this will still serve to point to the broad aspects of nutritional research in public health.

Nutrition and Atherosclerosis

Our experimental approaches to the serious health problem of atherosclerosis are based on two fundamental needs: (1) In order to formulate a reasonable and effective program of control by preventive means it is essential that we have a means of evaluating and classifying subjects according to the presence of atherosclerosis and its degree of involvement; (2) the development of control methods must depend on quantitative procedures for the evaluation of the direction and rate of progress of the disease.

In order to assess the relative merits of serum cholesterol and lipoprotein measurements in detecting and predicting the course of atherosclerosis, we have continued our survey of a large number of normal human subjects and also of persons known to have atherosclerosis. Our present data will not permit us to discriminate between these two groups. However, a comparison of the serum lipids of 47 Guatemalan Indians with those of an age-matched group of 47 New York executives reveals that the levels are approximately 30 per cent lower in the Indians. If it is true, as is often assumed, that primitive groups with vegetarian diets do in fact have less atherosclerosis than do Americans, then this finding may be significant and reflect the reliability of the measurements.

The relationship between obesity and atherosclerosis has been studied in a large clinical experiment. Significant weight reductions in 39 patients revealed that the serum lipoproteins are significantly reduced by this procedure in those patients with initially high levels, but are not significantly altered in patients with initially low levels. The cholesterol levels are unchanged.

If the hypothesis relating high serum levels of lipoproteins to the development of atherosclerosis can be confirmed, then this experiment will supply evidence indicating the beneficial effect of weight reduction.

Since there has been no satisfactory experimental animal for the laboratory study of atherosclerosis, a major accomplishment during the past year has been the development of a technic for the production of hypercholesterolemia and atherosclerosis in the Cebus monkey. This New World primate has been studied in this laboratory for the past four years. It has been possible to produce in a few months by dietary means a form of atherosclerosis which resembles that seen in humans.

Dietary restriction of cholesterol and fats, both animal and vegetable, does not influence lipoprotein molecules or serum cholesterol unless the diet is almost completely devoid of these materials. Such restriction is impractical in treatment and makes it difficult to maintain good nutrition. Therefore, from a practical viewpoint and on the basis of present knowledge, the best diet for the person with atherosclerosis is one which provides good nutrition—which means meat, milk, eggs, vegetables, cereals and fruits, with calories to maintain desirable weight.

Fat Emulsions

It is not possible to provide a severely malnourished individual with adequate calories if these must be supplied by vein, as is necessary frequently in individuals with a variety of acute and chronic wasting diseases or in cases of severe starvation. Fat emulsions that can be given by vein offer an opportunity to overcome this difficulty. In the past years this laboratory has been concentrating on this important problem. Recently, fat emulsions given intravenously have received extensive clinical trial. A considerable number of patients have been given a liter or more of intravenous fat per day for various periods to study the pyrogen problem involved with such emulsions and to accumulate additional data on the response of patients to such infusions. These additional data further substantiate the fact that fat so administered is well tolerated and utilized. An extensive animal program is under way for the testing and development of emulsions containing new stabilizers and new lipids as energy sources.

At the same time studies on intermediary fat metabolism have been in progress. In these studies the fate of radioactive fats and fatty acids is being determined following their metabolism by intact animals or slices of animal tissue. The influence of the nutritional and hormonal state of the animal is being investigated. Tissues such as the heart, liver, kidney and lung readily metabolize fatty acids but respond to fasting and carbohydrate supplementation to different degrees. Comparisons between the metabolism of fatty acids by normal tissue and by tumor tissue are being made.

Alcoholism

Alcoholism is a problem of increasing public health importance. To explore the etiology of alcoholism this laboratory is conducting researches in nutritional factors affecting the metabolism of alcohol and alcohol consumption. Current studies of the metabolism of ethanol have been confined to laboratory animals. Fasting has been shown to decrease the percentage of a given dose of alcohol metabolized. For example, after injecting 2.4 gm. of alcohol per kilogram of body weight in a fed rat 93 per cent of the radioactive carbon is recovered in seven hours, whereas only 59 per cent is recovered in seven hours from an animal fasted 48 hours. In the study of thiamine deficiency and alcohol metabolism, it has been demonstrated that as body weight decreases due to thiamine deficiency, the amount of alcohol metabolized, as indicated by radioactive $C^{14}O_2$ recovered, decreases. The effects of metabolites, hormones and drugs on alcohol metabolism are being investigated, particularly those used in treating alcoholics. In cooperation with the Alcohol Clinic of the Peter Bent Brigham Hospital, studies have been in progress since 1950 in which 225 patients are given large dosages of vitamin medications or placebos, and all receive similar medical consultation.

Obesity

Because of the high incidence of obesity in this country and because it favors the onset of many of the degenerative diseases it is certainly an important problem in contemporary public health. While all observers agree that obesity is the result of an imbalance between energy intake and energy expenditure, the mechanism of this imbalance—i.e., the primary etiology of obesity—has remained largely unknown. This is due in part to the fact that so little is understood of the fundamental mechanism governing appetite and energy intake in normal experimental animals or man. The physiologic problem thus transcends the question of obesity.

A series of extensive experiments involving normal experimental animals as well as animals deprived of essential segments of the mechanisms regulating carbohydrate metabolism have permitted us to propose a "glucostatic scheme of regulation of food intake." According to this view, food intake and appetite are regulated by the rate of utilization of blood sugar by two symmetric centers situated in the hypothalamus; therefore, both the sugar level and the rate of glucose utilization are regulated by the hypothalamus. In diabetes, or in hunger diabetes, blood sugar levels may be high but utilization is reduced.

The problem of obesity proper has been attacked in experimental animals and in man. Two main experimental models have been used: hereditary obesity in mice and hypothalamic obesity in rats. The hereditary obesity-diabetes syndrome of mice, described in this department, is characterized by massive adiposity, hyperglycemia, low oxygen consumption, sterility, short life span and characteristic superficial lesions. It has been possible to unravel in part the mechanism of its development. The primary lesion appears to be a defect in the utilization of acetate, one of the intermediaries in the oxidation of fats. Administered radioacetate will be retained mostly as fatty acids and for a smaller part as cholesterol to a much greater extent than in nonobese animals. This "biochemical lesion" in turn makes the animals excessively sensitive to pituitary diabetogenic hormone.

Hypothalamic obesity has been known both in man and in experimental animals for a long time. Its mechanism, however, is largely unknown. In hypothalamically obese rats, two phases can be individualized—an active and a static phase. During the active phase, in spite of excessive food intake, levels of nonfasted blood sugar are subnormal, indicating profound alteration of metabolism. During the static phase, food intake falls off while blood sugar values approach or exceed normal. The mechanism of these alterations has been studied. Indications are that various hypothalamic centers control the release of certain hormones. In particular, the obesity center controls the release of luteotrophic hormone, a finding interesting in connection with the adiposogenital syndrome. Another center, the destruction of which prevents eating altogether, has been studied and may be the area sensitive to variations of blood sugar.

In man, a study was made of the methodology of dietary surveys as they apply to obese individuals. From a physiologic standpoint the carbohydrate metabolism of obese men and women has been studied. Again it has been possible to differentiate between active obesity, the period when food intake, if unchecked, is excessive and will lead to weight gain, and static activity, when simple maintenance of overweight is associated with a relatively smaller intake and decreased activity. During the active phase it was found that the patients exhibited increased glucose tolerance, i.e., glucose, whether ingested or injected, is rapidly removed from the blood and presumably transformed into and deposited as fat. During the static phase one finds normal or decreased tolerance to glucose.

Heart Disease and Nutrition

Because of the continuous activity of the heart it is obvious that its muscular tissue must be well supplied with energy. This energy comes from food. To obtain energy from food, the body breaks down the food into simple chemical compounds such as lactic, pyruvic and acetic acids that are oxidized, energy being yielded in the process of oxidation. In

these oxidative processes, many of the vitamins have an important part to play as components of enzyme systems. For a number of years studies have been carried out in this laboratory to determine the effect of various vitamin deficiencies on the ability of cardiac muscle to utilize various food substrates. The latter have included glucose, lactate, pyruvate and acetate—many of them marked with radioactive carbon to facilitate their study. The vitamin deficiencies so far studied include thiamine, niacin, folic acid, pantothenic acid, biotin, and pyridoxine. In all vitamin deficiencies studied, some abnormality in the utilization of foodstuffs by heart tissues has been observed. It seems certain that the ability of the heart tissue to utilize foodstuffs efficiently is impaired in a great variety of experimental vitamin deficiency states, although beriberi heart disease (thiamine deficiency) is the only familiar clinical entity.

Coronary heart disease—We have some leads in the experimental production of this important disease in monkeys. Diet is relevant. Our large monkey colony (40 monkeys) is devoted solely to these studies.

Mechanism of formation of edema—The interrelations of protein deficiency and salt intake with regard to edema formation are being studied.

Cancer

Experiments utilizing our new method for the experimental production of cancer continue. The method consists of dissolving certain fat-soluble chemical compounds, such as dimethyl benzanthracene, in fat, preparing emulsions of the materials and injecting them intravenously. By this means a high incidence of mammary tumors can be obtained in female rats. The rapidity with which the tumors appear and their multiplicity in a given animal are dependent on the dose of carcinogenic material given. Other compounds such as sex hormones can be incorporated in the emulsions in order to supply the mammary cells with the carcinogen and the hormone at the same time. Certain hormones have been found to accelerate greatly the appearance of these mammary tumors and to increase their multiplicity. Studies are also being initiated to test the influence of the intravenous administration of various fat-soluble materials on developing tumors.

Metabolic Function of Intestinal Mucosa

The intestinal mucosa is an active tissue of the body, and is important because of its role in absorption. Many nutritional deficiencies produce gastrointestinal disease, but little work has been done to find why this happens. We have developed an active and promising study of this problem.

Nutrition Studies in the Elementary and Secondary Schools

Our research in this area has been put into a slide film and a monograph. The aim is to find effective means of introducing sound nutrition education into the standard curriculums of public schools.

Nutrition Problems in Advancing Age

We are trying to delineate more carefully nutritional problems in geriatrics with the hope of launching studies to apply the vast background of research in nutrition to the serious problems in society today of keeping older people in good health.

Radioactive Protein Studies

The effect of stress on protein metabolism is being studied by means of radioactive protein obtained by growing algae in an atmosphere containing radioactive carbon dioxide.

Institute of Nutrition in Lima, Peru

This year two staff members and one student are in residence in Lima. Studies on the nutritional composition of native foods and the extent of nutritional disease are under way. As part of our cooperative researches with the Institute of Nutrition in Lima, Peru, we have recently completed a study in the Peruvian Federal Penitentiary showing that the calcium requirement for adult men is only about 25 per cent of the amount generally quoted.

Health Problems of Mothers and Children

SAMUEL B. KIRKWOOD, SAMUEL W. DOOLEY AND HAROLD C. STUART

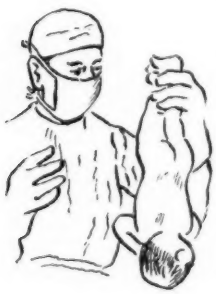
Harvard School of Public Health, Boston

An attempt is made by the authors to indicate certain concepts which must be utilized to bring women to and through a healthy childbearing period, to bring the greatest number of infants successfully through the period of infancy and to provide a favorable environment for healthy development of children. To accomplish these aims, proved measures must be used more widely and others must be sought out. Such measures are best used in ways which provide continuity and individualization.

1. Protection of Woman's Health Throughout the Reproductive Cycle

S. B. KIRKWOOD*

PROTECTION of the woman against the hazards of reproduction is a basic law of life, as natural as reproduction itself. It is not a human prerogative but a fundamental attitude of nature, instinctive throughout the animal kingdom. This, therefore, is not a new public health concept. But the full appreciation of what these hazards to the pregnant woman are, how they operate and what preventive measures can be taken has come slowly. Beginning with the earliest simple efforts to check the mother's condition before delivery, the scope of prenatal care has been widened to the present day feeling that a given pregnancy is not an isolated incident in the woman's life to be cared for on the spot, but that protection of her health through her reproductive life span is truly a lifetime job.



Out of this attitude has come this modern threefold concept of maternal health:

1. That maternal health care starts with the baby girl at birth, continues with observation through her preadolescent growth, prepares her for puberty, carries her through the development of her reproductive stature, trains her for her pregnancies and conducts them safely, checks her between pregnancies and leads her through the trials of the menopause to a happy and comfortable old age.

2. That specific but varying hazards—physical, emotional and economic—exist at all stages of this cycle.

3. That these varying problems must be met by varying means at each stage.

The practical application of this concept of total maternal care

*Assistant Professor of Maternal Health, Harvard School of Public Health, Boston, Massachusetts.

can be reduced rather simply to a careful analysis of the problems to be met at each period of pregnancy and to the development of technics for resolving them—to find, in short, at each phase of pregnancy what can be done, what should be done, and how best to do it.

The obstetrician rarely sees his prospective patient in her preadolescent years. Here the doctor in the smaller community has the distinct advantage of observing the family as a unit. It is possible for him to see his patient grow up. Thus he can correct nutritional deficiencies, do his part in preventing debilitating diseases such as tuberculosis, rheumatic fever, and nephritis and, perhaps most important of all, he can help to provide through her parents the proper emotional, social and economic environment for her advancing development.

With the onset of puberty, physical growth and development bring all the problems of menstruation and sexual maturity. The emotional problems that accompany this physical change may be severe, for the young girl must now psychologically realign herself to a new position in her family and the community. What she learns and does at this point in her life conditions her whole approach to her own part in marriage, family and community. Perhaps at no other time in her reproductive life is there more need for proper preparation, counseling and training to establish proper attitudes toward her sexual and social development and to protect her from physical disease and moral trauma. Her support must be straightforward, authoritative, factual teaching that can come only from the combination of parents, the teacher, the nurse and the doctor. Needless to say, this training must antedate and coincide with her physical development.

As the adolescent girl grows and marries, she approaches the preconceptional period. It is in this phase that she falls into one of four distinct groups:

1. The normal. Here, reassurance is the treatment.

2. Those in whom pregnancy becomes a suicidal risk. Here the facts must be tactfully, gently, but plainly presented and all possible help given in changing the young woman's focus toward other proper substitute activities.

3. Those in whom pregnancy is temporarily contraindicated because of untreated or uncontrolled disease such as active tuberculosis, uncontrolled diabetes or acute rheumatic fever. Here the obvious therapy is directed toward the complicating disease with postponement of pregnancy until after elimination of the complication.

4. A very small group in which serious diseases occur, such as Huntington's chorea. Here again the situation must be carefully explained to the woman and efforts made to help her into other channels. The doctor quite naturally is the only one qualified to be of this service.

In the actual prenatal period, maternal care comes into an acute focus for the first time. At this time certain clearcut steps must be taken.

1. The mother must have a thorough check of past illness and health with particular reference to her ability to bear children.

2. She must have a thorough physical examination, both general and pelvic, including mensuration of her pelvis. This study must include checks on weight, blood pressure, hemoglobin, blood grouping and Rh, urinary check for albumin and sugar, a Wassermann test, and a chest x-ray.

3. Her nutritional status must be evaluated.

4. She must be seen at sufficiently frequent intervals so that no complications arise. At each visit her urine should be checked for albumin and sugar, and her blood pressure and weight should be recorded. She should be quizzed for any symptoms of complications. The development of the fetus should be watched. Her eating habits should be noted.

5. She should be given information throughout her pregnancy as to the development of her baby and the changes taking place in her body. General and specific hygiene and nutrition must be explained. Cognizance must be taken of the emotional, social and economic factors which may have direct or indirect bearing on her health during pregnancy. In short, she, together with her husband and family, should be coached and prepared for the climax of delivery and the return home with the new baby.

Undoubtedly the most immediately dangerous time in the mother's life is the period of labor and delivery. Although her past condition and preparation will have much to do with her ability to withstand the trauma of delivery, her safety and that of her baby lie for the most part in the hands of the doctor, nurse or midwife who delivers her. Thus there is no substitute at this time for properly trained personnel and adequate facilities, especially for dealing with complications.

The postpartum period is one of readjustment, care being directed to:

1. Aiding in the normal processes of involution, and checking by proper physical examination to be sure they have taken place.

2. Providing full protection against infection, to which the mother is particularly susceptible at this time.

3. Enhancing a normal relationship with the baby in feeding, physical care and emotional response.

4. Protecting the mother's physical and emotional health against the dangers and difficulties of an altered family and community environment.

One of the most neglected phases of the care of the mother's health is the interim period between pregnancies. At no other time can previously discovered abnormalities be so readily and leisurely treated in expectation of a better pregnancy in the future. These corrections apply also to deficiencies of family relationships and of social and economic conditions.

Finally, maternal health care can in no way be considered complete unless steps are taken to mitigate the dangers and discomforts of the menopause and advancing years. Many of these, in fact, stem directly from experiences of childbirth. Nor should those interested in training each succeeding generation overlook the influence of the older upon the younger.

It must be amply apparent that the success of this type of care demands men and women of skill, and that providing it is a big job. Fortunately the individual doctor has many workers who can help him if they are available—the visiting nurse, the nutritionist, the social worker, the psychologist, the health educator, the city and state departments of health and the hospital clinic. Whether the doctor is working alone or as a member of a clinic team, it is imperative that mothers get these essentials of care.

2. Major Hazards of Infancy

THE business of being an infant remains the most hazardous of all occupations despite the miraculous decrease in infant mortality in those areas of the world where present knowledge has been applied for his protection. Those concerned with the achievement of this low infant mortality rate have just reason for

pride in their accomplishment. It is a reasonable assumption that higher infant mortality rates in other areas are subject to improvement by known measures, and that the causes of death in excess of the most favorable rates easily may be ascertained. Diarrheal diseases, malnutrition, infections which are simply prevented or easily treated, and improper obstetric procedures immediately suggest themselves as examples of such causes. These we know how to prevent or to treat, and the problem is chiefly the effort necessary to do this universally.

S. W. DOOLEY*

Even where infant mortality rates are lowest, there remain some few deaths which are preventable by known measures. Among the remainder, certain conditions are common which with newer knowledge may become preventable within the foreseeable future. Most important among these are premature births and congenital malformations.

Many physiologic disturbances or illnesses in the mother during pregnancy lead to premature births. The evidence indicating that maternal diet during pregnancy is more frequently poor in groups of prematurely born infants than in control groups appears significant. In certain areas of India where maternal anemia is nearly universal, the wide scale administration of iron to pregnant women has markedly reduced the number of premature births.

The production of specific deformities in animal fetuses by controlled provision of an unfavorable fetal environment may lead to clues elucidating the production of similar deformities in humans. Maternal German measles and toxoplasmosis during pregnancy as yet remain the only two conditions known to produce human congenital malformations. It appears more than probable that similar observations of other conditions will explain additional groups of anomalous fetuses.

During the natal and neonatal periods in areas with low infant mortality rates, deaths caused directly or indirectly by anoxia constitute the majority of fatalities. Many of these result from antenatal events and are therefore inaccessible to accurate diagnostic procedures or truly effective treatment. However, when fetal distress is obviously present, therapy directed to the mother during labor may be of value to the fetus. The use of oxygen and antibiotics has been recommended in such circumstances, and anesthetics and other agents depressing vital processes of the fetus should be withheld.

In these same periods of infancy, infection remains a very common event and should be suspected in nearly all fetuses and infants whose vital functions are not being well performed. When labor is prolonged after premature rupture of the fetal membranes, it is not uncommon for the fetus to succumb to a fatal septicemia before delivery. Signs of infection in the newborn may be confusing or absent, and many infants die of infection which was clinically unsuspected.

Respiratory difficulty is commonly seen beginning some hours following birth, particularly in premature infants. Most such episodes are thought to be caused by the presence of an homogeneous eosinophilic material thickly lining the expanded alveoli and preventing air from entering others which then collapse. Administration of oxygen, control of humidity and maintenance of a quiet, undisturbed environment are somewhat effective, but many of these infants die.

The most marked decrease in the number of infantile deaths has occurred in the age groups past the neonatal period. Formerly, acute and chronic nutritional disorders, diphtheria, congenital venereal disease, enteric infections, pneumonia and other infections contributed many casualties. Presently these afflictions are comparatively rare in those areas where current knowledge of prevention and therapy is effectively utilized. In other areas they continue to exact a large toll.

Tuberculosis has yielded moderately to therapy, but the successful control of this dis-

*Assistant Professor of Child Health, Harvard School of Public Health, Boston, Massachusetts.

ease in infants must still rely primarily on prevention of exposure.

Pertussis remains a serious threat to very young lives and although an effective vaccine is available, complete prevention or uniformly effective treatment is a goal that is yet to be attained.

It must not be forgotten that in all the foregoing conditions in which successful control is possible, continuous and aggressive effort must be directed toward this end. Such control is based largely on underlying public health measures, trained personnel and an informed population.

As infectious diseases cause fewer infant deaths, accidents become more prominent as causes of deaths and crippling injuries. The infant becomes more able as he grows and develops—more able to establish improper contact with electrical appliances, to stretch up and turn on the jets on the gas stove, to upset containers of scalding fluids upon himself, to roll off a bed or bath table onto the floor, and to gain access to and ingest poisonous substances. With the increasing prominence of such events as major causes of injury and death to infants, it becomes obvious that countermeasures need be taken. Most effective as such are awareness on the part of parents that these dangers are present in every home and knowledge as to how to eradicate or minimize them. This can be accomplished only by active educational measures carried on as both community and individual projects.

Statistics are invaluable, but no baby is a statistic. Each is an individual, functioning increasingly independently as a member of our society, with his own assets and liabilities. When a community has a very low infant mortality rate there is just reason for pride but not for satisfaction. Instead it is necessary to ask about each individual death: What wasn't done that was needed? What was done that should not have been? How can the next baby with the same difficulty be more effectively aided to survive or to survive undamaged? What about the health and fitness of all infants who survive? When these questions are asked and answered, there will be just reason for satisfaction.

3. Protecting the Health and Development of the Child

H. C. STUART*

At each stage of development from conception to adult maturity, the individual has special needs and is subject to particular hazards to health. At each stage he is particularly subject to certain diseases and his response to any one disease tends to differ in some or many respects from that which is characteristic for other stages. These particular susceptibilities or responses account for wide differences in morbidity and mortality rates, period by period. They stem in the main from the facts that the young human organism is small and is growing, that he is immature but developing in many structures and functions, that he is ignorant and inexperienced but, through repeated experiences, is learning and acquiring knowledge, habits and capacities which, under suitable environmental conditions and maternal care, permit increasingly successful adaptations and resistance to many diseases.

Because of these features of early life the infant or child is far more susceptible to unfavorable aspects of environment and is to a very large extent dependent on maternal care and protection, this dependency diminishing with time. The fetus requires the specially designed environment of the womb of a healthy mother for at least two-thirds of the course of normal pregnancy, and if born prematurely the infant requires during the third trimester very special care and protection under artificial conditions outside the mother's womb. During the rapid, essential adjustments from intrauterine to extrauterine existence, all infants require special care for a period of two to four weeks beyond the routine care needed during later infancy.

*Professor of Maternal and Child Health and Head of the Department, Harvard School of Public Health, Boston, Massachusetts.

TABLE 1

AGE PERIODS OF LIFE PRIOR TO MATURITY

PERIOD (SYNONYM)	APPROXIMATE AGES REPRESENTED	EXAMPLES OF CHARACTERISTIC FEATURES
Embryonic	First trimester of prenatal life	Rapid differentiation; establishment of systems and organs
Early fetal	Second trimester of prenatal life	Accelerating growth; elaboration of structures; early functional activities
Late fetal	Third trimester of prenatal life	Rapid increase in body mass; completion of preparation for postnatal existence
Parturient	Period of labor and delivery	Risk of trauma and anoxia; discontinuance of placental circulation
Neonatal (Early infant) (Newborn)	First month of postnatal life	Postnatal adjustments in circulation; initiation of respiration and other functions
Infant proper (Middle infant)	1 month to 1 year	Rapid growth and maturation; increase in functions, especially of nervous system
Transition (Late infant)	1 to 2 years	Decelerating growth; progress in walking and other voluntary motor activities and in control of excretory functions
Preschool (Early childhood) (Runabout child)	2 to 6 years	Slow growth; increased physical activity; further coordination of functions and motor mechanisms; rapid learning
School (Midchildhood)	Girls: 6 to 10 years Boys: 6 to 12 years	Steady growth; developing skills and intellectual processes
Prepubescent (Late school) (Early adolescent)	Girls: 10 to 12 years Boys: 12 to 14 years	Accelerating growth; early adolescent endocrine and sex organ changes
Pubescent (Adolescent proper)	Girls: 12 to 14 years Boys: 14 to 16 years	Secondary sex character maturation; maximum growth increase
Postpubescent (Late adolescent) (Youth)	Girls: 14 to 18 years Boys: 16 to 20 years	Decelerating, terminal growth; rapid muscle growth and increased skills; rapid growth and maturing functions of sex organs

From Brenneman's Practice of Pediatrics, Vol. 1, chapter 2, Hagerstown, Maryland, W. F. Prior Co., Inc., 1948.

For convenience in considering the health needs of children, specified age periods are dealt with separately on the basis of the characteristic features of each. Table 1 lists those age periods in common use and suggests important characteristics of each. For convenience in organizing services, maternal and newborn services are grouped together and appropriately surround the maternity hospital setting. Infant and preschool child services are organized in the physician's office or in health conferences readily accessible to each section of the community.

In dealing with the problems of infants and young children, the main objective is to help the mother understand and meet the special needs of her own child, and the two problems are essentially medical evaluation and counsel and health education. Health services at this period, therefore, are best given by a physician and a nurse in a cooperative effort.

Services for the child of school age and for the adolescent are ordinarily provided in the physician's office or in the school, or are divided between educational health services at the school and personal medical care services in the physician's office. Although the problems basically are the same, the child must be dealt with more directly, school personnel are involved and more cooperative effort is required.

There is a well recognized human pattern for all aspects of growth and development in

childhood, but there are wide individual differences in the patterns manifested by healthy children—in magnitudes and rates of change, in timing of events and in other ways. For satisfactory evaluation, therefore, the physician must know the child and appreciate his inherent capacities, his relative maturity for age, his potentials for growth and development, and other characteristics. He must, in short, evaluate the child's progress in terms of his own expectancies. Many conditions interfere in one way or another with the full accomplishment of a child's potentialities for growth and development. Unfavorable social, psychologic and nutritional conditions, lack of opportunities for play, training and activity, as well as acute and chronic diseases, all play their part. Protecting the growth and development of the child, therefore, involves at all ages the provision of an adequate diet for his individual needs, the provision of such opportunities for play and activity and experience as are necessary to promote his full development, protection from all unnecessary diseases and accidents, and the provision of a suitable home and community environment.

It becomes apparent that satisfactory results can be obtained for the individual child only when there is comprehensive consideration of him as an individual, of his home and environment and his habits of life. The episodic attention to specific problems when they arise, without consideration of the individual and his past experiences and reactions, fails to meet his needs in many instances. Continuity in health services for infants and children from period to period is highly desirable, with records which follow the main aspects of his growth and development and health experiences over the long range. Only thus can the significance of findings at one examination be appreciated, particularly from the standpoint of the child's ultimate development and fitness. Since continuity is of such great importance, it is highly desirable that the same physician follow the child's growth progress over long periods of time, coming to know well his personality and potentialities and his mother's competence, attitudes and problems, and thus be able to advise and guide on the basis of personal understanding. Under such a system the routine application of immunizations and the teaching of safety measures, the giving of dietary advice and attention to problems of mental as well as physical health fall into their proper places naturally. Such service contributes to continuing overall enhancement of the mother's competence to deal with her child effectively and later to the child's understanding of himself and his ability to deal with his health problems successfully. Under these circumstances, the health examination becomes a logical supplementary source of information to and a check on the findings under health history and not merely a routine search for pathologic conditions. Interest on the part of all concerned is tremendously enhanced by the personal relationships thus established, by the individualization of the interpretations made possible and by the opportunity to think in terms of progress and fitness for the individual rather than merely of delineating between normal and pathologic states.

At the Harvard School of Public Health

PROTECTING THE HEALTHY *(right)*—Dr. Samuel E. Dooley, Assistant Professor of Child Health, examines a healthy 1 year old baby at the Child Health Division of Boston's Children's Medical Center. The well-child division is a joint enterprise of the hospital and the school.

CONTRIBUTING TO WORLD HEALTH *(left)*—Dr. William M. Schmidt (second from right), Associate Professor of Maternal and Child Health, meets with the Expert Committee on Maternity Care, World Health Organization, in Geneva. At the table (left to right) are Miss Kathe Brotherus, Nursing Supervisor of Teaching and Demonstration Field, Helsinki, Finland; a member of the WHO staff; Dr. Sharvu Pandit, Adviser in Maternity and Child Welfare, Directorate General of Health Services, New Delhi, and an alumna of the Harvard School of Public Health; Dr. Schmidt; and Professor Sarwono Prawirohardjo, Department of Obstetrics and Gynecology, University of Indonesia School of Medicine, Jakarta.

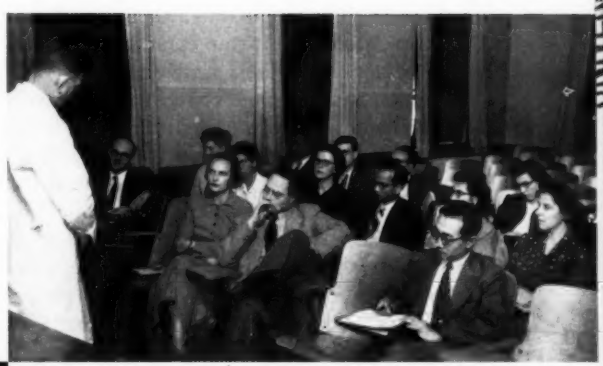
PUBLIC HEALTH DEANS *(below)*—Deans of four of the nation's 10 schools of public health attended a conference on mental health in public health training programs at the Harvard School of Public Health in June 1952. They are (left to right) Dr. Ernest L. Stebbins, Dean of Johns Hopkins School of Public Health; Brig. Gen. James S. Simmons, USA (Ret.), Dean of the Harvard School of Public Health; Dr. Thomas Parran, Dean of the University of Pittsburgh School of Public Health; and Dr. Harold W. Brown, Dean of the Columbia School of Public Health.

HARVARD SCHOOL OF PUBLIC HEALTH *(above)*—Main building of the School at 55 Shattuck Street, Boston, is located in the midst of an important health area. Administrative offices as well as the Departments of Biostatistics, Public Health Practice, Industrial Hygiene, Physiology and Maternal and Child Health are located in this building.

BREATHING ASSISTANCE FOR POLIO VICTIMS *(left)*—Continued studies on breathing difficulties of polio patients have been made possible by grants from the National Foundation for Infantile Paralysis. Here General Simmons (right) accepts a check for $24,500 from John D. Kelley, Chairman of the Middlesex County Chapter of the National Foundation, while Dr. James L. Whittenberger, who will direct the research, looks on. The iron lung in the background is one of several later models which the School has acquired since the lung was invented at the School by Professor Philip Drinker, now Head of the Department of Industrial Hygiene.

PUBLIC HEALTH FORUM SPEAKER *(right)*—Dr. Robert A. Kehoe (center), Professor of Industrial Medicine and Director of the Kettering Laboratory, University of Cincinnati, was one of a distinguished group of visiting public health specialists who spoke to combined faculty-student forums during the last year. Dr. Kehoe is shown talking with General Simmons (left) and Professor Drinker before lecturing on "The Public Health Approach to Air Pollution Problems." Other recent forum speakers have included Sir Allen Daley, Honorary Physician to the late King George VI and former Medical Officer of Health, London County Council; Dr. N. H. Swellengrebel, Professor of Parasitology, University of Amsterdam; and Dr. Mark D. Hollis, Assistant Surgeon General of the U. S. Public Health Service.

INTERNATIONAL HEALTH CENTER *(below)*—An informal seminar following a laboratory period in Tropical Public Health is held by some of the 1952 class. The names, native countries and present positions of these alumni are: (left to right) Dr. J. S. McKenzie-Pollock, Scotland, Regional Advisor in Treponematosis in the New Delhi office of the World Health Organization; Dr. Ram B. Abeysinghe, Ceylon, Medical Officer of Health, Colombo, Ceylon; Dr. Johannes Holm, Denmark, Chief of the Tuberculosis Section, Division of Communicable Diseases, World Health Organization in Geneva; Dr. Halvecio Brandao, Brazil, Assistant Professor of Microbiology, University of São Paulo, Brazil; and Dr. James A. Edgett, Canada, Veterinary Consultant to the Pan-American Sanitary Bureau in Peru.



VISITING SPECIALIST *(above)*—Dr. William T. Green, Orthopedic Surgeon-in-Chief at Boston's Children's Medical Center, lectures to one of the Maternal and Child Health classes. An integral part of one of the nation's important health areas, the School draws visiting lecturers and research specialists from the Peter Bent Brigham Hospital, Beth Israel Hospital, Children's Medical Center, Boston Lying-In Hospital, Harvard Medical and Dental Schools and the New England Deaconess Hospital, all of which are within easy walking distance of the School.

Solving a Community Health Problem

JOHN E. GORDON, HUGH R. LEAVELL AND THEODORE H. INGALLS*

Harvard School of Public Health, Boston

Epidemiology is applied to mass disease to define course and extent of the problem, and determine the multiple factors acting in causation. After analysis, operational control is sought by team effort directed against selected causes, with results to be evaluated at the end of the operation.

SOLVING a community health problem is a complex and systematic operation that involves several steps. A satisfactory result depends on a variety of skills, trades, scientific disciplines and businesses. It requires the combined effort of persons of divergent interests, some medically trained, others nonmedical. For some problems—poliomyelitis, for example—participation by practicing physicians of the community is indispensable; for others—such as chronic lead poisoning from high test gasoline—action may be taken by persons only indirectly concerned with medicine or public health.

No ready gauge distinguishes disease or injury as a concern of the community in contrast to an affair of the individual. The older and rather well accepted criterion that prevention is the business of public health, and medical care the function of the private physician, no longer holds. As firm a principle as any is that health and disease become an obligation of the community when the individual lacks the ability or capacity to manage them through his own effort. Each single person cannot take the responsibility for purity of his water supply; therefore the provision of safe water is an obligation of the community. Selective medical care may become a function of society and thus of public health, sometimes for economic reasons, through cost of the service or a limited capacity to pay, and sometimes because of residence or occupation where such services are not readily available.

J. E. GORDON

T. H. INGALLS

Although the private practitioner of medicine is directly concerned with medical care of the individual, he also has responsibilities in prevention, and consequently with mass disease and the public health. When an automobile accident occurs the need may be for a physician or a neurosurgeon or an orthopedist, depending on the injury. For specialist or practitioner to feel wholly unconcerned with the prevention of future accidents is to take a false view of present day professional responsibility and to avoid the social obligations that rest in the practice of medicine. To take part in solving community health problems is a duty of the medical profession and

*Departments of Epidemiology and Public Health Practice, Harvard School of Public Health, Boston, Massachusetts.

SOLVING A HEALTH PROBLEM

EPIDEMIOLOGY — PUBLIC HEALTH PRACTICE

1

I. DETERMINATION OF NATURAL HISTORY

Of the disease or other health problem unaffected by control measures to identify its cause of origin in:

A. HOST FACTORS

1. Intrinsic characters
   Age, sex, ethnic group
2. Physical constitution
   Anatomical structure, physiologic state nutrition
3. Psychical constitution
4. Acquired resistance and susceptibility
   Natural - tissue, humoral
   Artificial - active, passive
5. Natural resistance
   Genetic

B. AGENT PATTERNS

Methods for identification, determination of dosage factor, etc.

1. Biological
   Bacteria, viruses, fungi, helminths, protozoa
   Determination of life cycle, factors affecting multiplication, virulence, etc.
2. Physical
3. Chemical

C. ENVIRONMENTAL PATTERNS

1. Physical
   Weather, climate, season
   Soil, terrain
   Geography
2. Biological
   Animal reservoirs, anthropod vectors
   Food supply
3. Social
   Constituent groups - territorial, organizational face-to-face, family
   Population density and mobility
   Occupations and other roles and statuses
   Activities
   Cultural values
   Customs, beliefs, attitudes
   Technological developments
   Transportation, schools, housing, provisions for health services

II. DETERMINATION OF THE EXTENT OF THE PROBLEM

1. What proportion of the people are affected?
2. How serious are the effects on the host?
3. How serious are the effects on the community?
4. Time relationships - Improving or retrogressing
5. Geographic distribution

III. RESEARCH

1. To learn more of the natural history
2. To find new control measures

2

PLANNING THE STRATEGY OF CONTROL

based on knowledge of the natural history and the strategic points at which control measures may be applied

Strategic population groups in which the problem is centered, and on which the program should focus

Physical factors
Mental factors
Resistance factors
Genetic factors

} Control measures which may have an effect favorable to man

Strategic points at which the agent is most vulnerable to attack, and control measures available for use

Strategic points at which changes of environment may affect the health problems favorably for man, and control measures available for use

Priority Determination

How important is the problem to the community as a whole in comparison with other problems the community must face?

Estimate of the practicability and desirability of applying the available control measures in the light of available community resources, public reaction and other factors in the total situation

3

THE TACTICAL CONTROL PROGRAM

THE HEALTH DEPARTMENT
(or other health agency)

1. Discussion of Information available about strategy of control, priorities, costs, availability of personnel, facilities, supplies, transportation, etc.
2. Agreement by the Staff
3. Agreement by the Board

STEPS TOWARD COMMUNITY APPROVAL AND COOPERATION

THE PUBLIC

1. Consideration of how community attitudes, beliefs and customs relating to the problem may affect the control programs
2. Information about how widely disseminated available knowledge of the problem is
3. Information about willingness to pay for the program and to participate to make it successful
4. Information about availability and cooperation of channels of communication.

GOVERNMENT
(Or Governing Body of & Voluntary Health Agency)

1. Support of the Chief Executive
2. Legal authorization
3. Cooperation of other departments concerned
   Welfare, Education, Agriculture, etc.
4. Agreed priority of program in the light of the total plan of government (or other agency)
5. Appropriation of necessary funds

OTHER HEALTH AGENCIES

1. Support of the community health planning agency.
2. Support of the health professions
3. Coordination of the program with activities of other health agencies which may be involved.

ORGANIZATION AND ADMINISTRATION OF THE PROGRAM

1. Define the objectives and the job to be done
2. Provide a director
3. Determine the work units
4. Establish and perfect the structure of the work team

HEALTH EDUCATION

RESEARCH

1. To find better ways of applying the available knowledge of control methods
   a. more efficiently and economically
   b. to larger groups of people

THE COORDINATED SERVICE PROGRAM
directed at the applicable LEVELS OF PREVENTION.

1. Promotion of health
2. Specific protection
3. Early diagnosis and treatment
4. Disability limitation
5. Rehabilitation

Made available to

STRATEGIC GROUPS OF THE PUBLIC

EVALUATION OF RESULTS

FIGURE 1

of all physicians, whether primarily concerned with medical care or with the prevention of illness and injury.

Definition of the Problem

Whatever the community health problem, whether of typhoid fever, accidents, cancer or a vitamin deficiency, the approach, let alone the solution, is scarcely possible without understanding its nature and size. In short, the problem needs definition; and this is the first requirement of a community in meeting its health difficulties (Figure 1).

The role of the clinician—The physicians of the community have the initial responsibility, since the first step is to recognize and classify the disease. The odds are that it will be one with which both they and the community are familiar, but there is the further obligation to measure the clinical severity which it presents. More than once an altered clinical characteristic has permitted the clinician to give warning of an impending epidemic. In those rarer instances where the disease is strange, the practitioner may provide the lead that furthers understanding and control. It was the clinician who first knew that pandemic influenza was making inroads in his community in 1918; it was he who first dealt with Donora smog in Pennsylvania in 1948.

The private practitioner, as much as any one person, measures the potentialities of extension and ultimate spread, for he knows from firsthand experience the disease and its complications, the people who are becoming sick, the community and its resources. The main responsibility for prevention and control may fall to the lot of others, but planning and operation of a program for medical care remain the duty of the physician. That obligation is as important as the other in solving the community problem, whether the situation is an impending epidemic of communicable disease, an undue prevalence of a chronic degenerative condition or an excess of industrial or other injuries. The praiseworthy endeavor to stop further damage in no way lessens the obligation to remedy that already done. The physician has every right to feel that this too is a community responsibility and to call for such aid as may be necessary.

Finally, the practicing physician is at the very core of public health activity every time he reports a diagnosis to health departments. The community comes to rely mainly on him for information as to the nature and course of existent disease, the expression of its costs in terms of death, defect and disability, and in large part for the plan ultimately devised to cope with it.

The role of the medical sciences—Evaluation of a problem of mass disease is accomplished not only through observations made at the bedside but also through laboratory data which are the contribution of the medical sciences. Laboratory analysis is usually undertaken to confirm diagnosis, to determine pathogenesis and to reveal the causative agents, whether these be of bacterial, chemical or physical nature. Laboratory procedures also serve to reveal physiologic and anatomic features of the host in relation to resistance and susceptibility—agglutination tests for typhoid fever, for example. In general, the laboratory offers aids that are used in common by clinical medicine and public health.

Other than for such directly practical contributions in identification of disease and the extent of its immediate impact, the medical sciences provide the background of information which refines concepts of behavior and causality. The biochemical characteristics of micro-organisms, physiologic attributes of the host, and the ecologic manifestations of the environment are the fundamental determinants of what a disease is and does. This is the sort of information more than any other which so commonly lifts control of disease beyond empiricism and permits a scientific approach.

Epidemiologic analysis—Having defined the disease in terms of the individual and as a biologic process, through contributions of clinician and medical scientist, the next step is to measure the community problem. The first question is whether there really is a problem of community proportions. Ten cases of poliomyelitis or 10 automobile accidents within a two month period may represent an epidemic situation in a small town. In a New

York borough 10 such cases might signal the subsidence of an epidemic. Interpretation depends on comparison of the existing situation with the natural history of the condition for that particular locality.

Having determined that the specific circumstances represent a significant deviation from usual experience or accepted standard, the next step is to determine the extent of the current problem—specifically, the forces that brought it into being and presumably influence its future course. What are the proportions of people affected, the time relationships and the geographic distributions of the disease? Fundamentally these are matters for the epidemiologist or the astute clinician, just as the pathologist has the task to establish pathogenesis at levels of cell and organ.

Causative factors of community disease are of three categories: those of persons affected (the host); those of agents of disease, whether animate or inanimate, and those related to the environment in which both host and agent are found. Some causes are dominantly biologic and others sociologic. Thus biologic and social sciences expectedly contribute to better understanding of mechanisms that result in the continuation of mass illness.

Essentials of Control

For many maladies, notably the infections, existing knowledge suffices to formulate satisfactory programs for control. For others—arthritis and schizophrenia, to mention but two—knowledge is so inadequate that control programs are little more than visionary and await the fruition of research designed to clarify causation. In still other instances enough is known to justify community activity on a limited basis. Thus present day programs for cancer control are devoted largely to measures that promote early diagnosis and cure, with part of the objective the assembling of data on the kinds of persons affected and the circumstances under which malignant neoplasms occur.

To continue with cancer, part of the information needed is of the simplest kind—the mere location of cases. As pointed out in a recent editorial in the *British Medical Journal*, "Success in this will depend on the full cooperation of the surgeons, who are not always easily persuaded that statistics can throw light on pathogenesis." Yet that same issue of the periodical contains provocative statistics showing that death from gastric cancer is three times more common in some of the central counties of England and Wales than in others. Observed rates were correlated with existing social and environmental conditions and, notably, with characteristics of the soil.

Planning the Strategy of Control

This second objective in the process of solving a community health problem requires close collaboration of epidemiologist and public health administrator. Each calls on the information and skills of associates. The epidemiologist draws chiefly from the medical sciences, the administrator from the social sciences, and the clinician gives aid to both.

Decision is now taken as to factors acting in causation and behavior. It is toward these factors that attack is directed. The plan of campaign involves consideration of the relative importance to be given measures of control related respectively to host, to the agent and to the environment. There is also the practical consideration of how well the available control measures fit with community resources, public reaction and other governing factors in the total situation. To wage a city-wide campaign against tuberculosis in the whole of Detroit is to dissipate effort if the tuberculosis problem is sharply limited to one or two wards.

The Tactical Control Program

Having determined what the problem is and having decided on the most rational program for its solution, the next order of business is to determine the details for action. The health department, as the responsible agent of government in health matters, may be the logical agency to administer the program. Some voluntary health agency may be more appropriate. The principles are similar in either case. Information must be marshalled, priorities discussed, costs and availability of personnel and facilities determined

and a plan of action then developed.

The problem and the plan are then carried to the community for discussion and approval or revision. Community attitudes, beliefs and customs and information relating to the health problem are reviewed with the governing body to which the health agency is responsible. If there is a nonofficial community health planning agency or health council, it will bring together representatives of all community health agencies and health professions for coordinated planning. Through constructive criticism of these broader groups, and sometimes through community debate, general approval is reached. The tactical plan is ready for implementation.

The control program is carried out with the active aid of strategic groups of the public determined by previous study as being most involved. Organization follows the principles of good administration, which apply in health programs as in any enterprise involving numbers of people doing a job collectively. Particular measures are applied to the host, agent or environment at whichever levels of prevention they may be most applicable, that is, for promotion of health, specific protection, early diagnosis and treatment, disability limitation or rehabilitation. Appropriate health education is conducted during the organizational phase to lay the groundwork for more specific measures in the control program. Research must supply deficiencies in knowledge of administrative procedure just as in other phases of solving health problems.

Evaluation of Results

Realization of the program for control is an obligation of the public health administrator, acting as the agent of society. The final step in the action initiated to solve a problem of community health is a careful analysis of what has been accomplished. This turns the problem back to the epidemiologist who acts as does the auditor of a business concern, in surveying records of accomplishment, in determining the extent of progress and in providing the public health administrator with data by which to judge the efficiency of technical methods employed.

Summary

A precise definition of the existing situation is the first objective of a community seeking to solve a health problem. Since the question is of a population and not an individual, the approach is epidemiologic. Operational procedure is strongly a team effort. Clinical knowledge of the disease is the point of departure, with the medical and social sciences contributing importantly. With the problem adequately stated, the next step is to plan the strategy of control. This brings into play all determinable factors responsible for the origin and course of the situation at hand. The last step is to implement the decisions taken—that is to say, tactical action to limit extension and to remedy damage done. An objective and searching evaluation of results marks the end of the operation.

MEETINGS AND POSTGRADUATE COURSES

Combined Armed Forces Medico-Military Symposium: For all Armed Forces of the United States. May 6-8, at the United States Naval Hospital, Great Lakes, Illinois. Chairman of the Program Committee is Captain W. H. Schwartz, M.C., U. S. N.

American College of Cardiology: Second annual convention, June 7-9, at the Statler Hotel in Washington, D. C. The topic will be Diagnosis of Cardiac Diseases. Information may be obtained from the Secretary of the College, Philip Reichert, M.D., 480 Park Avenue, New York 22, New York.

Aero Medical Association: Twenty-third annual meeting, May 11-13, at the Biltmore Hotel, Los Angeles. Further information may be obtained from the secretary, Dr. Thomas H. Sutherland, P. O. Box 26, Marion, Ohio.

University of Minnesota, Minneapolis: Continuation course in arthritis and allergy for general physicians, May 11-13, at the Center for Continuation Study. Visiting faculty will include Dr. Walter S. Burrage of Boston. Course presented under the direction of Dr. C. J. Watson.

Continuation course in radiology for general physicians, May 21-23, at the University Hospital Department of Radiology. Program will be under the direction of Dr. Leo G. Rigler, Professor and Head, Department of Radiology.

American College of Allergists: Annual meeting, April 24-29, at Conrad Hilton Hotel, Chicago. For details, write the College, LaSalle Medical Building, Minneapolis 2, Minnesota.

Industrial Health

PHILIP DRINKER,* LESLIE SILVERMAN,** C. P. YAGLOU, ROBERT B. O'CONNOR AND ROSS A. McFARLAND

Harvard School of Public Health, Boston

A dynamic industrial nation, while producing an ever increasing abundance of material goods for man, also creates new environments and new health problems. Through research, teaching and service in comprehensive health programs, the Department of Industrial Hygiene is helping to conserve this industrial community's most important resources—its people.

PART 1

INDUSTRIAL disease has been recognized as a medical entity for several centuries. Lead poisoning was known to metallurgists like Agricola (1556) and to physicians like Ramazinni (1700). Thomas Reade in 1870 wrote a novel which gives a fine account of lead exposures in making files and of labor troubles following attempts to mechanize processes in order to eliminate health risks.

Sir Thomas Legge's memoirs[1] were a series of papers setting forth his unique experience as medical inspector of factories in Britain. Alice Hamilton's[2] and Carey P. McCord's[3] autobiographies deal especially with industrial disease. Before he became a famous novelist, Dr. A. J. Cronin wrote some good papers on silicosis among British iron and coal miners. All of these are good reading and give a fine background for an understanding of modern industrial hygiene.

*Professor of Industrial Hygiene, Harvard School of Public Health, Boston, Massachusetts.

**Associate Professor of Industrial Hygiene, Harvard School of Public Health, Boston, Massachusetts.

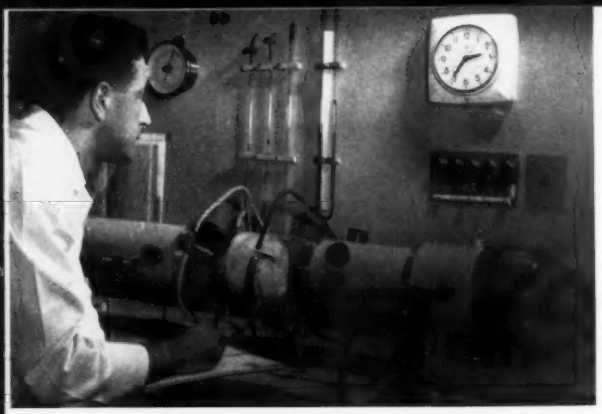
P. DRINKER

L. SILVERMAN

Prevention of industrial disease often falls to the lot of the engineer. Success or failure usually can be gauged by the nearness with which the employer fulfills Legge's advice: "Bring an influence to bear external to the workman (i.e., one over which he can exercise no control) and you will be successful; and if you cannot or do not, you will never be wholly successful."

Cleaning dirty air so it is fit to breathe is definitely an engineering job. The appraisal of results, in terms of health, is medical. There are few fields in public health today in which a joining of effort by engineer and physician is so clearly indicated.

The advent of the atomic age raised greatly the specifications for air cleanliness. Plants using atomic energy had potential risks to their workers and to others outside their plants which could be avoided only by keep-



ATOMIC ENERGY COMMISSION RESEARCH—Mr. August T. Rossano, Jr., Research Fellow in the Department of Industrial Hygiene and a Senior Sanitary Engineer, U. S. Public Health Service, operates experimental apparatus for testing aerosol filters in connection with the U. S. Atomic Energy Commission Air and Gas Cleaning Project at the Harvard School of Public Health. The air cleaning project is under the supervision of Dr. Leslie Silverman, Associate Professor of Industrial Hygiene.

ing exposures safe inside and outside the plants. The result has been some authoritative work on various aspects of air cleaning.

The American Industrial Hygiene Association, founded in 1939, publishes annually a list of concentrations of various impurities which can be breathed safely—virtually specifications for the degree of air cleanliness required. In effect they are comparable to the various temperature scales Professor Yaglou discusses (pages 325 to 326) under air conditioning.

Within recent years interest in the effects of noise in industry has increased. Prevention and control will follow the same pattern as that set up for dust control—the problem must be defined and the limits set before

WHERE'S THE NOISE?—Locating industrial noises which affect the health of workers is one of the jobs of Dr. Charles R. Williams, Assistant Professor of Industrial Hygiene at the Harvard School of Public Health and Director of Applied Research, Loss Prevention Department, Liberty Mutual Insurance Company. Despite the availability of several electronic devices designed to do the work, Dr. Williams finds that the everyday physician's stethoscope does the best job of pointing out the location of offending noises in machinery such as this generator. (Photo courtesy of Liberty Mutual Insurance Company.)

substantial improvement in industry can be expected.

Anyone dealing with health in industry is mindful of the essential role played by workmen's compensation laws. Today it is recognized that accidents or disease "arising out of or in the course of one's occupation" are compensable. The rules are understood and accepted in both the letter and the spirit of the law. The formulation and subsequent enforcement of these laws probably have done more than anything else to bring industrial disease under control. Today industrial diseases like silicosis or benzol poisoning, arising from employment, represent only 2 or 3 per cent of the cases which come before the various state industrial accident boards. Of these 2 or 3 per cent the majority are skin diseases resulting from contact with various substances. The remainder, over 95 per cent, are accidents in the accepted term—injuries from falling objects, broken limbs, strained muscles, foreign bodies in the eye, and the like.

An important difference between the accidents and the diseases is that the latter are cumulative and require, usually, repeated exposures. Accidents, for the most part, occur at definite times and places and are not cumulative in their effects.

It is not easy to get workmen into the frame of mind in which they will go to special trouble to avoid accidents. Legge was right; prevention must be something beyond the workman's control or he will either disregard it or forget it. It is easier to prevent illness from breathing air impurities than to make a man always wear his protective goggles. We can do something very definite about the dirty air but we have yet to find a sure way to make man prevent himself from being injured.

REFERENCES

1. LEGGE, THOMAS: Industrial Maladies. London, Oxford Medical Publications, 1934.
2. HAMILTON, ALICE: Exploring the Dangerous Trades. Boston, Little, Brown & Co., 1943. (See also Hamilton and Hardy's "Industrial Toxicology," 1949.)
3. MCCORD, C. P.: Blind Hog's Acorns. Detroit, McCloud, 1946.
4. JOHNSTONE, H. F. (ed.): Handbook on Aerosols. United States Atomic Energy Commission. Government Printing Office, 1950.
5. Harvard University Air Cleaning Laboratory (ed.): Handbook on Air Cleaning. United States Atomic Energy Commission. Government Printing Office, 1952.
6. DRINKER, PHILIP and HATCH, T. H.: Industrial Dust. New York, McGraw-Hill, 1935. (Under revision.)

2. Environmental Control

C. P. YAGLOU*

THIS year marks the fiftieth anniversary of "air conditioning," an important tool in environmental control. During the last 30 years of this period the objectives of environmental control have been placed on scientific footing. Much has been learned concerning the reactions of man to his environment, body heat production elimination and regulation at rest and at work, acclimatization to heat and cold, and water and salt balance. Various scales of warmth have been developed, principally the effective temperature, operative temperature and equivalent temperature, to integrate three or all four of the environmental thermal factors into a single index. Comfort zones have been developed for winter and summer seasons, and ventilation standards have been established that are now in common use in this country and abroad. The Harvard School of Public Health, among other institutions, contributed its share to these developments.

In industry, two primary motives for air conditioning are the requirements of the product, or process, and production efficiency. The field of application is largely confined to the manufacture of hygroscopic materials where the benefits can be evaluated on a monetary basis. Complete air conditioning solely for the comfort or health of workers is the exception rather than the rule, because the human benefits are less tangible and in many instances difficult to prove.

Thermal standards for industrial occupations are still meager and difficult to establish, owing to many variables which cannot easily be evaluated. It is possible, however, to define limits of temperature, radiation, humidity and air movement for efficient work. Sufficient data are available for estimating the economic loss of manpower when conditions of exposure are outside the normal safe limits. Responsibility for establishing practical standards rests largely with individual industries concerned with heat or cold.

Control of heat hazards in industries where radiant heat is a major factor places much reliance on isolation, radiant screening and hooding of the main sources of heat, and on spot cooling. Use of these measures, supplemented with adequate water and salt intake, has practically eliminated the occurrence of heat diseases in "hot-dry" industries.

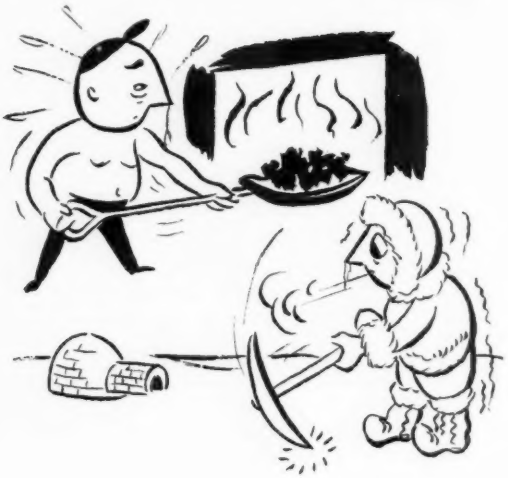
Not much has been accomplished in protecting workers from moist heat. Dehumidification of air on a large scale is impracticable and expensive unless the amount of moisture given off by processes can be controlled at the source. Spot cooling affords some relief when the wet bulb temperature is below the critical value of 95° F. The safe exposure time in moist air at 95° F. is one hour for light work and one-half hour for moderately heavy work. As much as two-thirds of the total shift time may be wasted for rest and recuperation.

Measures for controlling occupational exposures to cold are still inadequate. The warmest clothing made will not protect an inactive person for more than five hours at a temperature of 0° F., or more than one and one-half hours at –40° F. Handwear and footwear have greater limitations unless external heat is applied to them.

Cooperative studies with the Naval Medical Research Institute have indicated that persons becoming severely chilled to the point of collapse should be rewarmed fast, preferably in water of 100 to 105° F., in order to avoid possible shock or prolonged agony from shaking chills which characterize rewarming in air at 70 to 100° F. Even in the presence of cold-injured tissue, studies on rabbits at Stanford University indicate beneficial effects from rapid rewarming when pressure dressings are applied to such tissues.

The field of environmental control spreads over the whole range of human activity. In the field of therapeutics, air conditioning has been successfully applied to the institutional

*Professor of Industrial Hygiene, Harvard School of Public Health, Boston, Massachusetts.



care of premature infants, to operating and delivery rooms and to allergy wards, and in the treatment of heart failure, heat prostration, fevers and various other conditions which accompany summer heat waves.

Research in environmental control never has been in proportion to its importance, particularly in the health field. More and better standards should be developed for environmental control in industries. We should learn how to control drafts and exposure to sudden temperature contrast. Measures for air disinfection, sound control, lighting, etc. should be improved. More basic information is needed concerning climatic effects on the organism. The tropical and polar regions are the two large undeveloped areas of the world. With tropical diseases being brought under control, would it be feasible to raise the energy and efficiency levels of the natives by cooling their sleeping quarters so as to provide needed rest and recuperation from the effects of excessive daily heat? This is a challenge to the objectives of our national Point 4 Program.

REFERENCES

1. Yaglou, C. P.: Abnormal air conditions in industry; their effects on workers and methods of control. J. Indust. Hyg. & Toxicol. 19:12, 1937.
2. United States Department of Labor: Protecting plant manpower; practical points on industrial sanitation and hygiene. Division of Labor Standards Bulletin 3, 1941.
3. Committee on Atmospheric Comfort: Thermal standards in industry. In: American Public Health Year Book; part 2 of Am. J. Pub. Health 40:131, 1950.
4. Yaglou, C. P.: Hospital air conditioning. J.A.M.A. 110:2003, 1938.

3. Health Services in Industry

R. B. O'CONNOR*

INDUSTRIAL medicine began with pre-employment screening examinations and arrangements for treating the industrially injured worker. During the past 30 years the breadth and scope of health services in industry have increased until today industrial medicine involves itself in any and all problems relating to the worker's health. Its emphasis has changed from curative to preventive.

Today in industry the physician finds an opportunity to assist in improving and maintaining the health of the individual through the use of industrial preventive medical technics. Large industries have been able to develop this program readily because their size has made it feasible to hire a physician on a full time basis and hence they expect his full time interest in their many health needs. More recently, similar methods have been devised for smaller industries, using part time physicians and even part time industrial nurses in their plants. Small plants have been able to build industrial health programs comparable to those of the larger plants in scope and effectiveness when they have been able to bring into the plant part time medical personnel who are interested in developing a real preventive medical program.

While the scope of today's industrial medical practice will vary somewhat depending on the needs of the particular plant, a well rounded program consists of the following:

1. *Preplacement examinations*—Previously, these were examinations before hire to determine general employability, i.e., ability to do any kind of work. Now they are aimed at determining the physical capacities of the individual so that he may be placed in work that

*Assistant Professor of Industrial Medicine, Harvard School of Public Health; Medical Director, Loss Prevention Department, Liberty Mutual Insurance Company, Boston, Massachusetts.

is commensurate with his abilities and that will not exceed his physical limitations. Attention also is given to uncovering remediable conditions so that persons with such conditions may be referred to their family physicians for immediate care.

2. *Treatment of occupational injuries and illnesses*—First aid and follow-up care for injuries and illnesses arising out of and in the course of employment are a logical part of the in-plant medical program. Patients are referred for specialized care as needed. In-plant treatment assures prompt, competent care to minimize complications; it reduces unnecessary loss of time from work, and it facilitates job placement for rehabilitation.

3. *First-aid care for nonoccupational conditions*—Many individuals with minor medical indispositions visit the plant's medical facility. First-aid care alleviates symptoms and shortens or cures conditions in their early stages. For treatment beyond initial first aid the patient is referred to his family physician. Many of these are persons who would not otherwise seek a physician's help. Guidance and referral at that stage are an important part of industrial preventive medicine.

4. *Periodic examinations*—Examinations after hire are done on a variety of groups, e.g., those returning from illness absence, those exposed to toxic substances at work, those whose physical status may affect the safety of others, executive and other key personnel, those in the older age groups and, in an increasing number of plants, all employees. These examinations are made to assure continued physical compatibility with the job and to make job adjustments where necessary. But especially they are done to disclose physical changes in their earliest stages when corrective or preventive measures can be successful in continuing work effectiveness and earning capacity. An industrial preventive medical program cannot be complete without such periodic health examinations. Since the employee is referred to his family physician for any definitive treatment that may be needed, these health examinations constitute a significant case-finding program.

5. *Health counseling and health education*—Individual guidance and counsel by the industrial physician and nurse are available when needed for any matters relating to physical, mental or emotional health of a worker, and the employee is encouraged to use the in-plant medical facilities for such purposes. The gamut of problems is almost limitless and includes such things as a minor illness that is bothering the worker but is not yet disabling, problems in mental hygiene, advice regarding an ailing wife or child at home and many others. Referrals to family physicians or to one of the many community health welfare and social agencies are made when indicated. Increasing use is made of the materials for more formal programs of group or mass health education offered by the various health agencies.

6. *Plant sanitation and hygiene*—The industrial physician and nurse are also available to assist in handling whatever sanitation

or plant hygiene problems may be present or may arise. These include attention to food handling in the plant cafeteria, medical control of exposures to occupational disease and the like.

This brief outline suggests the breadth and scope of today's industrial medical practice. Its aim goes far beyond that of treating injuries. It takes pertinent parts of all the other special fields of medicine and applies them within the framework of industry to improve and maintain the health and working effectiveness of a presently able group of employees. Evaluating minor physical defects and minor clinical symptoms with the aim of keeping healthy workers healthy is a challenge that is not met to the same extent in any other branch of medicine except military medicine. So-called subclinical states are the daily concern of the industrial physician. Translating physical examination findings into an appraisal of physical capacities and limitations is a unique part of this work.

This whole health program must fit into the industrial scene, and therefore the physician in industry must be familiar with a wide range of relatively nonmedical information, such as labor-management relations, union contracts, workmen's compensation laws, the handling of compensation claims and materials, and production methods.

Industrial management is becoming increasingly aware of the value of a health service in industry, and many industries are developing comprehensive health programs for their workers. Industrial preventive medicine will become an increasingly significant factor in medical socio-economics. Indeed the growing adoption of voluntary prepaid group insurance plans by industry coupled with preventive in-plant medicine may well bring this country to whatever degree of "social security" it wishes to attain.

REFERENCES

1. Klem, M. C., McKiever, M. F. and Lear, W. J.: Industrial Health and Medical Programs. Public Health Service Publication 15, Federal Security Administration, September 1950.
2. American College of Surgeons: Medical Service in Industry and Workmen's Compensation Laws. Chicago, 1946.
3. National Industrial Conference Board: Company Medical and Health Programs. Studies in Personnel Policy 96, New York, 1949.

4. Prevention of Industrial Accidents

ROSS A. MCFARLAND*

The incapacity and loss of life resulting from accidents are as great as or greater than the losses from any known disease entity. High accident rates have resulted from increased mechanization of our environment and the high mobility of our population. Although the highest injury rates result from vehicular accidents, the incapacity and loss of life from industrial injuries remain very high. When age is taken into account, accidents rank as the leading cause of death between 1 and 24 years. This implies an enormous cost to the resources of the country in terms of years of productive output. Currently, in all three branches of the armed services, accidents rank first among the 10 leading causes of man days lost, separations from service and deaths.

Human factors play the most important role in the production of accidents, although in most instances there is multiple causation.[1] Since many of the same biologic laws are involved that are important in disease, the role of the agent and of the environment must be considered. Attempts at control should involve consideration of host, agent and environment.[2] Statistical methods have been employed to determine the relative contribution of these variables and their interaction.[3]

Study of the host, or individual worker, constitutes one of the most promising methods of reducing accidents. This relates to the effective integration of the abilities of workers with the physical and psychologic demands of their jobs. Psychologic tests can aid in the detection of special aptitudes, and the physical examination—if carried out on a functional basis—can prevent placement in which the employee would be a hazard to himself and to others. Visual tests have proved to be im-

*Associate Professor of Industrial Hygiene, Harvard School of Public Health, Boston, Massachusetts.

portant in screening and placement.[4] Persons subject to impairment of consciousness, from whatever source or clinical entity, must be given special consideration in placement.[5] Temporary attributes of the individual must be controlled, such as alcohol, drugs, fatigue, personal stress and emotional disturbances.[6]

There is some evidence that a small portion of the work force may account for a larger percentage of accidents than may be attributed to chance alone. Attempts have been made to describe the characteristics of these workers in terms of "accident proneness." Although the concept lacks experimental support, there is evidence favoring the recommendation that individuals who have repeated accidents be subjected to special study and corrective training.[7]

Many deficiencies in the work situation formerly attributed to human error are actually due to defects in the agent, vehicle or equipment itself. All types of machinery and working areas must be designed to meet human requirements and limitations.[3] Dials must be readily legible; controls must be within reach and designed to prevent inadvertent use when operating under stress.[1] A stable posture and adequate view of all operations are important. This implies that the construction of the working area and of various types of vehicles and equipment must be applicable to a wide range of body sizes in the work force.[8]

Greater control of adverse environmental influences is an important approach to accident control. Accidents tend to increase as temperatures become extreme or the humidity excessive.[9] Toxic agents such as carbon monoxide are known to be important in some industries as a cause of injury. Noise and vibration are contributing factors, especially if they interfere with speech communications and warning signals.

A significant reduction in industrial accidents can result only from adequate control of the worker, his equipment and the environmental setting.[10] Some improvement lies in the selection, training and supervision of the worker. Near accidents, critical incidents and emergencies provide valuable clues to the prevention of real accidents. Advance analysis in the design of equipment can meet human requirements in such a way as to eliminate the possibility of accidents. The working environment may be subjected to a high degree of control, and advance study may result in increased comfort and safety for the worker. Finally, morale, interest and attitude toward the job are very important and must be seriously considered in any successful program of accident prevention.[11]

REFERENCES

1. McFarland, R. A. and others: The role of human factors in industrial accidents. Proceedings of the President's Conference on Industrial Safety. Washington, D. C., United States Department of Labor, March 1949.
2. Gordon, J. E.: The epidemiology of accidents. Am. J. Pub. Health 39:504-515, 1949.
3. Chapanis, A., Garner, W. R. and Morgan, C. T.: Applied Experimental Psychology—Human Factors in Engineering Design. New York, John Wiley and Sons, Inc., 1949.
4. Tiffin, J.: Industrial Psychology. Ed. 3. New York, Prentice-Hall, Inc., 1952.
5. Poole, F. E.: Industrial physical examinations; objectives and methods. J.A.M.A. 133:91-97, 1947.
6. Bartlett, F. C.: Fatigue following highly skilled work. Proc. Roy. Soc. Med. (B) 131:247, 1943.
7. Tillmann, W. A. and Hobbs, G. E.: The accident prone automobile driver; a study of the psychiatric and social background. Am. J. Psychiat. 106:321-331 (November) 1949.
8. King, B. G.: Measurements of man for making machinery. Am. J. Phys. Anthropol. 6:341, 1948.
9. Winslow, C.-E. A. and Herrington, L. P.: Temperature and Human Life. Princeton, New Jersey, Princeton University Press, 1949.
10. Heinrich, H. W.: Industrial Accident Prevention. New York, McGraw-Hill Book Company, Inc., 1950.
11. Blake, R. P. (ed.): Industrial Safety. New York, Prentice-Hall, Inc., 1944.

Dr. Edward S. Murray, associate professor of microbiology, examining typhus-infected chick embryos.

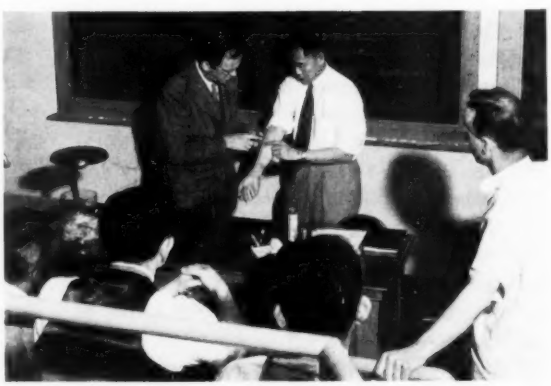
Villagers in Yugoslav province of Bosnia who cooperated with Dr. Murray during typhus surveys in summers of 1950, 1951 and 1952.

Dr. Snyder at work in isolation room of infectious disease laboratory.

Wood tick, reservoir and vector of Rocky Mountain spotted fever.

Photomicrograph of murine typhus rickettsiae in cytoplasm of rat cells.

COMBATING INFECTIOUS DISEASES—The Department of Microbiology of the Harvard School of Public Health is primarily concerned with the micro-organisms which cause certain of the insect-transmitted diseases of man. Some of the department's teaching, research and service activities are illustrated here.



Classroom demonstration of a skin test to show susceptibility to diphtheria.

Research in Microbiology at the Harvard School of Public Health

JOHN C. SNYDER*

Harvard School of Public Health, Boston

The current research program of the Department of Microbiology of the Harvard School of Public Health includes several problems which were selected for their public health implications as well as for their intrinsic academic interest. The staff is primarily concerned with the micro-organisms which cause certain of the major insect-transmitted epidemic diseases of man. Investigations are being conducted on the biology of certain intracellular parasites, the rickettsiae; studies are in progress on various arthropods as experimental hosts for viruses and rickettsiae, and knowledge is being sought concerning the epidemiology of various epidemic diseases.

J. C. SNYDER

THE current research program of the Department of Microbiology of the Harvard School of Public Health includes several problems which were selected for their public health implications as well as for their intrinsic academic interest. We are primarily concerned with the micro-organisms which cause certain of the major insect-transmitted epidemic diseases of man. For purposes of brevity, it is convenient to describe the problems under four topics: (1) biology of the micro-organisms, (2) biology of the insects which harbor or transmit these microparasites, (3) chemotherapeutic studies and (4) epidemiologic features.

Biology of Micro-organisms

The outstanding problem in microbiology today is to gain knowledge of the phenomena of growth and reproduction of various micro-organisms which have not been successfully cultivated outside living host cells—for example, leprosy bacilli, typhus rickettsiae, spirochetes of syphilis, yaws and relapsing fever, and the many viruses of animals and plants. These micro-organisms are important because they seriously affect the health of the human as well as the plant and animal populations of the earth. The common cold, measles, mumps, poliomyelitis and influenza viruses are ubiquitous and familiar in the human population; less well known, but nonetheless serious, are the viruses of hepatitis, and the arthropod-borne encephalitides. Several animal diseases of great economic importance are viral in origin, such as hoof-and-mouth disease and hog cholera. The few examples just enumerated are typical representatives of the whole group of uncultivated micro-organisms which we refer to as intracellular parasites since they appear to multiply only within the cells of susceptible species.

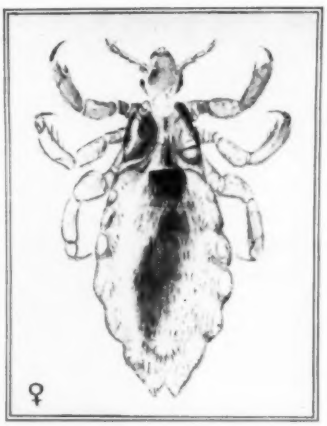
The intracellular parasites occupy our attention even more prominently today than they did 50 years ago because most of the bacteria, when knowledge of their growth had been obtained by the pioneer bacteriologists, were brought under control by the development of preventive methods and more recently by the use of antibiotics and chemotherapeutic agents. In respect to the intracellular

*Professor of Microbiology and Head of the Department, Harvard School of Public Health, Boston, Massachusetts.

parasites, however, our knowledge today is about where knowledge of most of the bacteria was many years ago. To be sure, advantage is taken of the ability of some micro-organisms to propagate in animals, in chick embryos or in tissue cultures, but we do not know what the intracellular parasites require for growth and multiplication. Until this knowledge is available, many important questions about intracellular parasites must remain unanswered.

In the Department of Microbiology of the Harvard School of Public Health one phase of this general problem is being actively investigated. Among the many uncultivated intracellular parasites the typhus rickettsiae seem most suitable for an attack on the problem of growth requirements. Rickettsiae are large enough to be seen readily in the ordinary light microscope. They resemble free living bacteria morphologically, and thus it seems reasonable to assume that their dependence on host cells may be less extensive than that of the small viruses.

Although the primary problem, that of cultivation in cell-free mediums, has not yet been solved, our studies have revealed several interesting phenomena. When separated as well as possible from the protoplasm of the host cells in which they grew, the rickettsiae survive for longer periods if certain substances are provided in the suspending medium. For example, potassium is better than sodium; sucrose has a protective effect; albumin is helpful, and glutamate is definitely enhancive.[1] When care is taken to preserve viability of the rickettsiae, we have shown that these micro-organisms have an independent metabolic activity, utilizing oxygen to form aspartate and ammonia from glutamate.[2,3] These observations have opened a new line of investigation into the properties of rickettsiae and possibly also of certain viruses. At the present time we are searching for further information on the biochemical properties and composition of rickettsiae and are seeking to provide a medium in which they multiply. In approaching the growth requirement problem we are utilizing other possibilities for study—namely, tissue culture technics, cultivation in neoplastic tissues of animals in vivo and in vitro, and use of arthropods (described in next section). The search for substances which reverse the action of antibiotics may also provide clues to the growth requirements of the intracellular parasites.



Pediculus humanus var. *corporis.*

Biology of Insects

A second major endeavor of the Department of Microbiology of the Harvard School of Public Health is the study of the arthropods which transmit or harbor certain of the intracellular parasites. In our laboratory a technic has been developed for quantitative studies of blood-sucking arthropods.[4] By means of this technic it is possible to use human body lice, for example, in laboratory studies just as we use mice and rats in various quantitative aspects of experimental infections. The use of laboratory-reared arthropods for the propagation of certain micro-organisms has advantages over the use of mice, rats or chick embryos, particularly in view of the control thus afforded over the temperature and other important environmental factors. The technic opens the way for a concerted attack on various problems of growth and metabolism of microparasites and of interrelationships in the physiology of the arthropod host and the parasitic micro-organism. Furthermore, it is now possible to consider laboratory experiments which may provide information on mutations in those microparasites which propagate in arthropods. Knowledge of spontane-

ous and induced mutations in rickettsiae and viruses may explain their evolutionary aspects and may offer the opportunity to develop, in the laboratory, human avirulent strains eventually suitable for the immunization of man.

Chemotherapeutic Studies

Efforts to find a satisfactory treatment for epidemic typhus fever early in the second world war led to the discovery that the simple chemical compound, para-aminobenzoic acid, arrests the multiplication of rickettsiae.[5] The observation provided a beginning for the chemotherapeutic attack on rickettsial infections. Although the mode of action of para-aminobenzoic acid on rickettsiae has not been elucidated, we have shown in collaboration with Dr. B. D. Davis of the United States Public Health Service that there probably is a competitive antagonism between para-aminobenzoic and parahydroxybenzoic acid.[6,7]

While the new antibiotic, terramycin, was in the development stage in the Pfizer laboratories, samples were submitted to us for trial; the potent antirickettsial properties of terramycin were clearly shown by our experiments in chick embryos and mice.[8] Our research program presently includes an active interest in compounds of potential antirickettsial or antiviral activity.

Epidemiologic Studies

Epidemic louse-borne typhus fever is one of the diseases which have, over the centuries, taken a huge toll of human lives. Dr. Hans Zinsser was concerned with the way in which typhus could be maintained in the intervals between epidemics. He made a special study of Brill's disease, which is the sporadic, relatively mild form of typhus noted among immigrants who had formerly lived in a typhus zone of Europe. Zinsser developed his hypothesis that the micro-organisms causing typhus were able to persist somewhere in the tissues of man after the patient recovered from the disease, and that years later the balance between host and parasite somehow became disturbed, resulting in a second attack of typhus.

In our department we have been completing Zinsser's work, which was interrupted by his death. By using our laboratory-bred colony of pedigreed human body lice, we have isolated typhus rickettsiae from 9 persons having Brill's disease. We have thus clearly shown that such persons can serve as foci of new epidemics of louse-borne typhus.[9] Furthermore, the frequent occurrence of hitherto unrecognized cases of Brill's disease in a typhus zone has been established, adding to the validity of Zinsser's hypothesis.[10]

Other epidemiologic studies have included the recognition of two other rickettsial infections in areas where these illnesses had not been identified previously, namely, Q fever in Yugoslavia[11] and rickettsialpox in New England.[12,13]

Our research program has been supported in part by the U. S. Public Health Service; the Surgeon General of the Army under the sponsorship of the Virus and Rickettsial Commission of the Armed Forces Epidemiological Board; the William F. Milton Fund; the Lederle Laboratories Division of the American Cyanamid Company; the Research Division of the Chas. Pfizer Company, and the Sterling Winthrop Research Institute.

REFERENCES

1. Bovarnick, Marianna R., Miller, Judith C. and Snyder, J. C.: The influence of certain salts, amino acids, sugars, and proteins on the stability of rickettsiae. J. Bact. 59:509, 1950.
2. Bovarnick, Marianna R. and Snyder, J. C.: Respiration of typhus rickettsiae. J. Exper. Med. 89:561-565, 1949.
3. Bovarnick, Marianna R. and Miller, Judith C.: Oxidation and transamination of glutamate by typhus rickettsiae. J. Biol. Chem. 184:661-676, 1950.
4. Fuller, H. S., Murray, E. S. and Snyder, J. C.: Studies of human body lice, *Pediculus humanus corporis*. Pub. Health Rep. 64:1287-1292, 1949.
5. Snyder, J. C., Maier, J. and Anderson, C. R.: Therapeutic effect of p-aminobenzoic acid in experimental murine typhus. Report to the Division of Medical Sciences of the National Research Council, 1942.
6. Davis, B. D.: Mechanism of PABA bacteriostasis: Competition with a new vitamin, p-hydroxybenzoic acid. Federation Proc. 10:406, 1951.
7. Snyder, J. C. and Davis, B. D.: Reversal of the rickettsiostatic effect of p-aminobenzoic acid by p-hydroxybenzoic acid. Federation Proc. 10:419, 1951.
8. Snyder, J. C., et al.: Experimental studies on the antirickettsial properties of terramycin. Ann. New York Acad. Sc. 53:362-374, 1950.
9. Murray, E. S. and Snyder, J. C.: Brill's disease. II. Etiology. Am. J. Hyg. 53:22-32, 1951.
10. Murray, E. S., et al.: Brill's disease. IV. Study of 26 cases in Yugoslavia. Am. J. Pub. Health 41:1359-1369, 1951.
11. ———: An outbreak of Q fever in Sokol, Bosnia, Yugoslavia, August 1950. Pub. Health Rep. 66:1032-1037, 1951.
12. Fuller, H. S., et al.: Studies of rickettsialpox. I. Recovery of the causative agent from house mice in Boston, Massachusetts. Am. J. Hyg. 54:82-100, 1951.
13. Eustis, Elizabeth B. and Fuller, H. S.: Rickettsialpox. II. Recovery of *Rickettsia akari* from mites, *Allodermanyssus sanguineus*, from West Hartford, Connecticut. Proc. Soc. Exper. Biol. & Med. 80:546-549, 1952.

Biostatistics — and Why!

HUGO MUENCH*

Harvard School of Public Health, Boston

Some guideposts along the road leading to a happier symbiosis of clinician and statistician are presented in this article. These include points to be considered in the planning of a clinical trial if its outcome is to have statistical (and so scientific) validity and the need for control of all possible aberrant variables to make observed differences referable to the factors tested.

H. MUENCH

To a good many clinicians, a biostatistician is a mechanism devoted mainly to asking embarrassing questions after it is too late to get an answer. To some extent the feeling is reciprocal, and some statisticians consider the clinician (at least, that part of the species writing papers) as an entity that never thinks of statistics in planning a piece of research until someone in an editorial room earnestly advises consultation with one of those people before resubmitting the paper for publication. At this time the statistician's questions seem to be mainly of the form, "Why didn't you get these and the other data?" and his more specific comments confined to "If you *hadn't* been such a blithering idiot, you might have thought of getting this information, and there would be a chance of telling whether your study meant something." At least that is more or less the way the clinician remembers the conversation—it might actually have been framed in slightly more polite terms.

It seems obvious that here there is something less than a meeting of minds, and that some of the fault lies in the timing of the statistician's consulting services. After all, if he *had* had a hand in the planning of the experiment, it might or might not have turned out better, but at least he would have been an accessory before the fact and in no position to scatter slurring remarks.

Is there anything to the statistician's point of view, more and more loudly expressed, that the time to call him in is when the study is being planned and not when it is time for publication? After all, the statistician is not omniscient, even to himself. He rarely knows as much about the background of an experiment as the man who plans to run it, and neither of them knows how it is going to come out if it is an honest and worthwhile experiment. So the reasons must lie in the statistician's own bailiwick and, if cogent, have something to do with his processing of the data after the study is done.

Actually this is the case, though it is amazing to see the wide variety of questions which the statistician will calmly classify as "statistical." Not that he hasn't good reasons, based on instances where neglect of some appar-

*Professor of Biostatics, Head of the Department and Assistant Dean, Harvard School of Public Health, Boston, Massachusetts.

ently remote factor vitiated the results of a long and costly study. Suppose we examine some of these "statistical" questions which should be answered before work on the project begins, and, to make the whole thing more concrete, relate them to some purely imaginary study which is to be carried out.

So here we have Dr. Fulano de Tal pregnant one morning with the bright idea that Antibiotic X might be very useful in the treatment of von Brudermörder's disease. At this stage his idea is just a hunch, and there is nothing against hunches, which are the starting points for most successful research, unless the hunch becomes a fixed idea to be defended against all evidence. De Tal's hunch rests, of course, on some observations previously made. Perhaps he has tried X in a case or two with what looked like encouraging results, or maybe he feels that X has been successful in other diseases which he thinks fall into the same category. So he is ready to invest a good deal of his time, and maybe that of his patients, in finding out just how good X may be.

Now the question is taking form, but so far it has not been stated in a shape that can be handled statistically—that is, scientifically, because all valid scientific information is statistical in nature, in at least a broad sense. "How good" implies a standard of some kind; "as good as" or "better than" or "worse," a comparison with something else. In this case, X must be compared with another treatment which has become accepted, or with no treatment at all, if there is none. Just because patients do well, or at least not badly, under a given treatment is no evidence in itself that they might not do as well or better without any treatment. This seems a reasonably trite sort of statement, yet, amazingly, it is at times lost from sight.

In passing, it is of course evident that no conscientious physician would try a new treatment unless he *did* have reason to believe that it was at least no worse than accepted therapy. That implies previous animal experiment in old diseases, or a complete absence of satisfactory treatment in new ones. Just as obviously, it is important to plan the first experiment so as to get a clear answer if at all possible. If the answer is blurred—if it appears that X *may* be a better treatment than an older one—then ethics forbid its being withheld in future cases, and only many years and thousands of cases later does enough empiric evidence accumulate to show that X is not so very good after all.

So Dr. de Tal decides to test Antibiotic X against whatever happens to be the accepted treatment for von Brudermörder's disease, and he wants to make his test as efficient as possible. If he doesn't have enough evidence to keep him from feeling dubious, he may test old treatment alone against old treatment *plus* X, but this does not lead to as clearcut results. Then arises another question: Just what is von Brudermörder's disease? Is it a clear clinical entity, or a diagnostic convention that covers a multitude of different things? Is the diagnosis sufficiently established that it means the same thing in Boston and San Francisco and Vienna? If these questions have unsatisfactory answers, it may be that the value of X will vary from time to time and place to place, depending on what happens to be included in this diagnosis.

Satisfied up to this point, Dr. de Tal faces the very important question of how he is going to measure the effect of the treatments. If the disease is virulent and has a fairly high mortality rate, an improvement in this rate is reasonably easy to measure and has the great advantage of being very objective, there seldom being much argument on whether a patient is dead or not. If the mortality rate is low, it will be necessary to accumulate so many cases before any difference in the number of deaths is statistically "significant" that the measure becomes hopeless and another must be used.

Since the measure is in terms of *outcome* of the case (not original diagnosis, which we assume is satisfactory) it must be in some terms of severity or duration. These are not always easy to measure, though reasonably objective facts like hemoglobin or blood count, or number of days with fever over a given degree, are available in some cases. Whether they are satisfactory depends on the

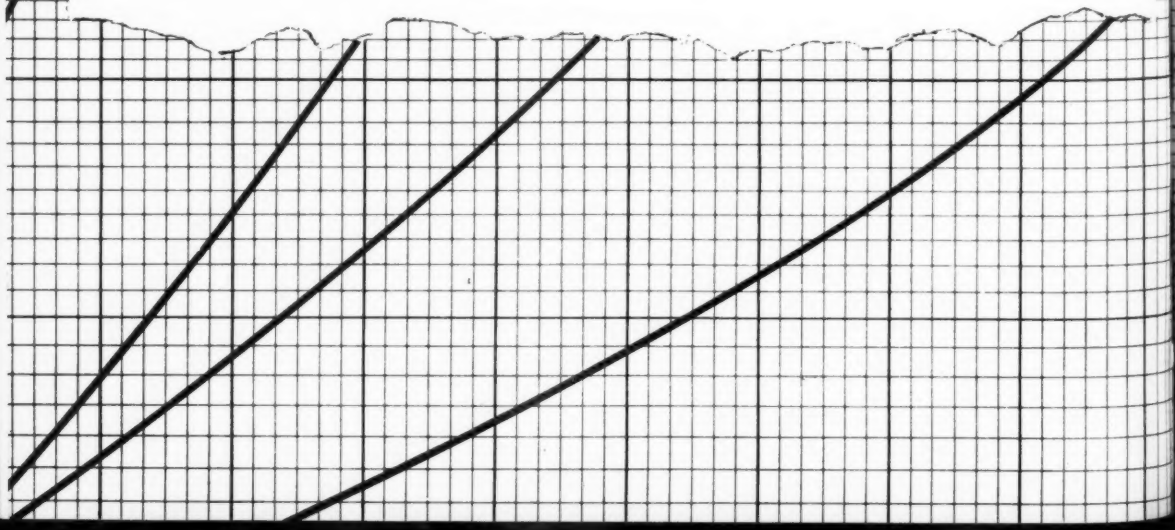
nature of the disease—the measure must be of something which is intimately connected with its progress. Hemoglobin measures, for instance, would be closely correlated with the status of a case of malaria but would have little meaning in pneumonia.

Subjective measures are very tempting, and on the whole are easier to make. The patient's own estimate of how he feels; the experienced clinician's judgment of clinical severity—these can be very useful measures, though harder to handle statistically than those which can be placed on a meter stick. But such measures are also subject to variations which have nothing to do with the actual status of the patient: Subjective factors enter in to distort subjective measures, and must be strictly controlled by means mentioned hereafter.

Finally, Dr. de Tal is ready to set up the study itself. He has decided on what measures he will use, and has limited the field of study to cases of von Brudermörder's disease which have met certain criteria of diagnosis and of general acceptability. Such limitation is quite proper, provided it is clearly understood in the beginning and strictly adhered to. For instance, inclusion of doubtful diagnoses might weaken the study. Acceptance of patients seen in a moribund stage would definitely weaken it, as presumably no treatment would be effective. There may be other reasons for limitation. Conclusions reached in this study apply, of course, only to the group as limited, but this is true for almost all clinical studies: Their results are not based on a random sample of the universe of all possible cases. However, if X proves to be definitely better in the special group (or doesn't, for that matter), it is reasonable to assume that the results would be similar in other groups.

Once the field and methodology of the study have been outlined, the very important question of planning adequate experimental and control groups remains. Antibiotic X is the experiment; the accepted treatment, or no treatment, is the control. Or accepted treatment is the control and adding X to this is the experiment. If conclusions are to be reliable, it is essential that there be no differences (except random ones) between the two groups other than that between control and experimental medication. This means that no systematic differences must exist between the groups in either their selection, their handling or in the application of any measures of outcome.

This sounds reasonable enough, and quite simple. There are, however, innumerable and tricky ways in which dat ol' debbil "Bias" can



sneak in. Nobody is going to select patients for treatment according to their "suitability" (it has been done, however) because the most "suitable" cases for trial of a new treatment are apt to be those with the best prognoses. This leaves the tougher cases in the control group with a difference in results practically guaranteed, and in the "right" direction.

An easy way, administratively, is to let volunteers try the new method and leave those who refuse in the control group. That would be fine, but would we expect to get entirely similar populations in the two groups? And would any differences perhaps be reflected in the outcome of the disease, even if the treatments of the two groups were the same? The volunteers may be the more intelligent—or more stupid—or may have reason not to be so afraid of the disease. These and many other factors could lead to a difference in results which *seemed* to be connected with the difference in treatment but actually had nothing to do with it.

The only safe way to set up the two groups is to let the decision rest entirely with Lady Luck. Once having decided that a patient is to be included in a study, the decision on the group to which he is assigned must be made entirely mechanically. One way is to have a series of envelopes, arranged by pairs, one in order assigned to each patient on his inclusion in the study and, when opened, telling in which group he is to be included. Whether the first of each pair is assigned to "experiment" or "control" depends on the toss of a coin or a similar random event. The point is that the decision to include a subject in the study must be entirely independent of the decision as to group. If not, some kind soul will manage somehow to get the less hopeful cases assigned to the treatment in which she has more confidence, and the validity of the experiment will be largely nullified.

But not only must the original assignment be at random; everything that happens from then on must be designed to let no systematic difference come in that is not directly a result of the treatment. It is axiomatic that the patient must not know to which group he belongs. If he is a control, he must receive a placebo indistinguishable from the treatment. If this does not seem quite fair to unsuspecting victims, the entire study must be restricted to a group of patients who are willing to undergo the test, not knowing whether they are subjected to a new form of treatment or not. Psychosomatic components bulk large in all therapy. They may or may not be effective in the case under consideration, but it is best to take no chances and to eliminate the possibility of such interference by keeping the patient in the dark.

The evaluator of results also must be in the dark. None of us, faced with the knowledge that Patient N has or has not received a given treatment, can help letting that knowledge influence him in his judgments. Sometimes this influence may carry little weight; at other times, when we use subjective methods of estimation, it becomes most important. Best, again, to eliminate this bias by not letting the knowledge in to confuse the results. Even the laboratory worker, in many smaller or larger ways, is influenced in her readings by previous opinion of what they should be. Best to keep her in the dark also, and to separate completely any of her subjective judgments from the outcome of the experiment.

In case some of this seems a bit overcareful and slightly insane, it might be mentioned that it has been found (after it was too late) that bias had come into studies in the most peculiar and unforeseen ways. The only safety lies in completely eliminating its possibility in every conceivable manner.

There is one exception to the rule of randomness. For example, it may be known or suspected that von Brudermörder's disease acts quite differently in males and in females, and in children and adults. Instead, then, of assigning all patients to study and control groups at random, they are first divided by age and sex into, say, four classes and then split into experimental and control groups at random in each class. This method of classification can be multiplied rapidly and lead to madness. Generally a very few classes are all that can be borne, and we must trust that the statistician's friend, randomness, will equalize unclassified differences between them.

Finally, there is one crucial question which is always thrown at the statistician by the experimenter (at least until he learns better): "How large must my groups of patients be?" This is connected with the matter of statistical "significance" which, again, is a matter of discounting Lady Luck. To be significant, a difference must be one that would occur rarely on an accidental basis. Small groups vary largely, just by "sampling" accidents—like successive hands in a game of bridge. As a corollary, groups have to be large enough before it can safely be said that an observed difference could not well have been accidental. A further corollary of this statement is that something must have caused the difference and this something must have been tied up with the difference in treatment. This last statement is true if there are no possible causes of difference between the groups except in treatment—which is why Dr. de Tal was so finicky about setting up rigid controls on every step of his study.

And how large is large enough? That depends, among other things, on the size of the difference, the variability between patients and the chance of error the experimenter is willing to take in stating that Antibiotic X has been shown to be a better treatment than the old one. The statistician cannot answer this question definitely unless Dr. de Tal can furnish him with particulars on these points. If X is a great deal better or worse, this fact can be demonstrated with relatively few patients. If it is only a little different, the groups may have to be very large. But generally Dr. de Tal would not be interested in demonstrating very small differences. So the statistician can eventually tell him: "If you are not playing for differences less than P per cent mortality (or an equivalent statement for other types of measures) and are willing to run a certain small chance of error in your eventual statement, you should arrive at a definite answer within these terms with N patients in each of your groups."

The clinician who has managed to read the above adventures may well wonder at this point just what is so technically statistical about this, and why most anybody, let alone a bright clinician, couldn't plan out a satisfactory program by himself. The answer is, of course, that he can and he should, and one of these days, God willing, he will proceed to do so—at least in larger numbers than he does at present.

The Importance of Tropical Public Health to World Peace

DONALD L. AUGUSTINE,* THOMAS H. WELLER,** AND RUTH A. THOMAS†

Harvard School of Public Health, Boston

The development of the natural resources of the tropics is progressing on an ever expanding scale. Concurrently, the native populations of these climates, usually disease-ridden and undernourished, are striving to improve their social and economic status. The continued availability of their resources, essential to our economy, calls for our cooperation. The improvement of health standards in the tropics will assist in the peaceful development of these areas.

D. L. AUGUSTINE

PUBLIC health, by promoting personal and national well-being, may be a powerful force in the mitigation of economic and political factors underlying the social unrest so prevalent in the world today. As a science, public health has no geographic or political boundaries. The designation "tropical public health" implies the application of the principles and technics of public health to the control and alleviation of the health hazards in tropical areas.

Several misconceptions are common. To the average inhabitant of temperate climes, the term "tropics" is associated with extremely hot and humid regions overgrown with jungle and sparsely populated. The health problems of the tropics are often visualized as being concerned solely with exotic diseases unrelated to those of temperate zones. Such generalizations provide a misleading picture. Actually, even at the equator, all climatic gradations are found, ranging from the intense heat of inland valleys to the Alpine temperatures of snow-capped mountains. The vegetation types intergrade from the rain forest and the grassland savanna to the sandy desert. Java, with a population density of about 1000 per square mile, is the antithesis of the sparsely populated jungle.

T. H. WELLER

R. A. THOMAS

The major health hazards in the tropics are infectious diseases and nutritional deficiencies. Contrary to the general impression, few of these are peculiar to the tropics. Tuberculosis, smallpox, venereal diseases and intestinal infections are problems of tropical and temperate regions alike, but in the former their significance is exaggerated by the prevailing environmental conditions. Most of the diseases found in the tropics are of worldwide importance. To these we may add a small

*Professor of Tropical Public Health and Executive Head of the Department; **Associate Professor of Tropical Public Health; †Instructor, Department of Tropical Public Health, Harvard School of Public Health, Boston, Massachusetts.

group of entities which are restricted solely to warm climates, and a few diseases such as malaria, yellow fever and leprosy, which formerly enjoyed an extended distribution but now persist primarily in tropical or semitropical countries.

Until the recent war, little was known by the world at large about the so-called tropical diseases. Except when dramatized through stories of the exploits of Manson, Gorgas, Lambert and other pioneers in tropical preventive medicine, they have been regarded as matters of concern only to research investigators, to physicians connected with medical missions or to industrial firms operating in the tropics. The pace of technologic developments within the last few decades, however, has quickened our awareness of the interdependence of the different parts of the world, and has focused attention particularly on the tropical or subtropical regions. From a purely humanitarian point of view we have come to realize that these underdeveloped lands which contain over half of the world's population can no longer be disregarded. Moreover, with the increasing dependence of industrialized nations on outside sources of raw materials, the tropics attain new significance in the world economy. For example, the largest proved reserves of petroleum are found in Iran, Saudi Arabia, Kuwait and Iraq—the Middle East. One of the primary sources of uranium is located in the Belgian Congo. A substantial part of the world's supply of tin comes from Southeast Asia, Indonesia, Bolivia and Nigeria. Extensive iron ore deposits are now being developed in Venezuela and in Liberia. Rich deposits of phosphate rock exist in Morocco, Algeria and Tunisia, and of industrial diamonds in Angola, the Belgian Congo and British West Africa. The last century was characterized by competition among the great powers for political control of unexploited sources of essential raw materials. Now the rising power of nationalism seeks to cast off the colonial system. Coincident with a growing social consciousness comes recognition of the necessity to enhance the industrial potentials of the people themselves.

In many of the tropical countries the development of civilization has lagged, with the result that the standard of living of the native inhabitants is deplorably low. Only the privileged few are able to rise above the handicaps of poverty, disease and illiteracy. The mortality rate in infancy and childhood is high and the span of life of the average individual is correspondingly short. Chronic, insidious diseases sap the physical and mental strength of the workers, while primitive methods of food production help to keep the nutrition of the people at subsistence levels.

Diseases of parasitic origin are foremost among the health problems of the tropical world. Throughout the centuries they, more than any other group, have contributed to the unsavory reputation of the tropics. They still constitute formidable barriers in many places to the utilization of material resources which are urgently needed to stabilize and expand our world economy. Under certain conditions these parasitic agents are responsible for serious epidemics accompanied by high mortality rates, but more often the diseases they produce are chronic and debilitating in nature. The inhabitants of endemic areas bear a continuous burden of illness. They cannot produce effectively and hence tend to become economic and political liabilities for the entire world. By relieving human suffering, tropical public health can help to combat economic stagnation.

Although the countries in the tropical and subtropical zones are predominantly agricultural, progressive urbanization and industrialization have accompanied the development of their natural resources. In earlier years the diseases of parasitic origin were of primary importance in rural areas where they handicapped the farmers engaged in the cultivation of food supplies and of crops for export. Now that the agricultural laborers are being drawn, to an increasing extent, into commercial enterprise and particularly into factories and mines, there is further deterioration in health standards, resulting from their migrations into overcrowded, poorly sanitated slum areas. In addition to chronic parasitism, tuberculosis and other diseases have therefore gained prominence as health hazards. The results

of chronic illness are reflected in low levels of production, not only of foodstuffs but also of the basic raw materials essential to life and to the stability of the world. The solution of this problem calls for adequate control of preventable diseases through the promotion of public health in these as yet underdeveloped areas.

Malaria

Although malaria is now uncommon in portions of Europe and of the Americas in which it was once endemic, it is still recognized as the most widespread of the serious infections of the tropics. Since it is usually a disease of rural areas, it is a major factor in maintaining low standards of food production. As a specific example, malaria in the Tersi foothill area of India has prevented the successful cultivation of a fertile and potentially productive region. At the present time it is increasing in prevalence in many parts of Africa. It is invading new territories and reaching altitudes in which it did not formerly exist.

Fortunately the public health measures now available for malaria control are far simpler, more effective and cheaper than they were in the past. The most effective procedure at present is based on the use of certain residual insecticides, particularly DDT®. The insecticide is sprayed on surfaces where anopheline mosquitoes may rest before or after a blood meal, at which time lethal quantities are absorbed through the feet. Because of the persistence of DDT on sprayed surfaces, it is effective for many months. In areas where malaria transmission is seasonal and due essentially to domestic species, a single yearly application usually is sufficient to break the cycle of infection from infected man to mosquito and from infected mosquito to man. The cost is astonishingly low; in some areas it is estimated at about 10 cents per person thus protected. Through this new principle of using residual insecticides, malaria control can now be extended even to relatively inaccessible parts of the tropics.

DDT already has produced spectacular results in numerous widely separated areas.[1] In Argentina an eradication project using residual DDT has reduced the prevalence of malaria to a point approaching extinction. The reports from Chile indicate that the chief mosquito vector, *Anopheles pseudopunctipennis*, has been eradicated. British Guiana, formerly notoriously malarious, has almost succeeded in wiping out the disease in the coastal plain region. In Venezuela active DDT residual spraying has been carried on since 1945, with the result that malaria is now relatively unimportant as a public health problem. The Venezuela project is of special interest, as it was the first residual spray campaign conceived with the objective of eliminating the disease from an entire country. Malaria, once the perennial scourge in Italy, Greece and the Eastern Mediterranean region, is no longer a common disease in these countries, due directly to the large scale use of DDT residual spraying. In Italy the malaria morbidity per 100,000 population was 900.6 in 1945, and 7.5 in 1950. Malaria in Greece was epidemic during and immediately following World War II. In 1951, however, the malaria rates fell to a point where it was considered safe to stop DDT spraying in most of Peloponnesus and in Crete.

Malaria is still a serious health problem in the Near East, Pakistan, India and Southeast Asia. Within recent years, the World Health Organization has cooperated with the various national governments in demonstration programs for the control of malaria in many of these countries. In the rice-growing districts in Pakistan, malaria control measures were directly responsible for increasing the crop production by at least 15 per cent.[2] After observing these results the local population expressed willingness to contribute two-thirds of the expenses for the continuation of the program. In tropical Africa little has been done thus far for the protection of rural populations against malaria, and in general this continent is still highly malarious. It is of interest to note, however, that the municipality of Kampala, once intensely malarious, now offers 1000 pounds to anyone who catches an anopheline vector of malaria within the town limits.[3]

Thus, with the advent of DDT, the prospect

now exists that malaria will cease to be a major public health problem in the tropics. As yet these local victories, important as they are, have not materially reduced the total world prevalence of malaria. In this new method of malaria control, however, we have an effective tool for the elimination of an important source of illness and nonproductivity. The resulting improvement in working efficiency must ultimately aid in promoting personal security, an important contribution to the cause of world peace.

Schistosomiasis and sleeping sickness, like malaria, also are serious obstacles to the economic development of the tropics. These diseases likewise are prevalent in rural food-producing regions of the tropics. Both are preventable, but practical methods for effective eradication have not yet been developed.

Schistosomiasis

Schistosomiasis is prevalent throughout most of Africa. It is a serious hazard to health in many parts of the Near East, South America, the West Indies and the Far East, including vast areas of China, Japan, Formosa and the Philippines. The economic loss to the world as a whole is incalculable. In view of present improved methods for its diagnosis, the statement that 150 million people have the disease undoubtedly represents an extremely conservative figure.[4] In Egypt alone over 50 per cent of the people suffer from schistosomiasis. It is estimated that this disease is responsible for a collective loss in productivity of about 40 per cent, and that its cost per year to Egypt amounts to at least $60,000,000. The discouraging fact is that as a result of the expansion of irrigation, schistosomiasis is spreading faster than it is being controlled. In Egypt the introduction of perennial irrigation has been responsible for an increase in schistosomiasis from 5 to 30 per cent in different districts. Attempts to increase agricultural production and to raise the standards of nutrition frequently have been nullified by the inroads of this disease. The Umshandige irrigation scheme in Southern Rhodesia, installed in 1939 at a cost of about $8,000,000, has been practically abandoned, largely because of the extension of schistosomiasis into the newly irrigated areas.[5]

A vast amount of basic research is necessary before the control of schistosomiasis can be realized, even in localized foci. For treatment, more efficient drugs which are suitable for mass administration are urgently needed. Attempts to eradicate the disease through improvements in sanitation and preventive education have been woefully unsuccessful. To date the application of copper sulfate and other molluscacides has resulted in a temporary eradication of the snail population in some areas, but nowhere has the essential snail intermediate host been eliminated. Recent observations, however, suggest the possibility that effective control of schistosomiasis may be attainable in the near future by the use of newly discovered molluscacides.[6-8] Dinitro compounds, particularly dinitro-C-cyclohexylphenol, have been shown to be toxic for the snail hosts of schistosomiasis. These compounds are active in high dilution, even in water which contains aquatic plants and a considerable concentration of organic matter. At present it would appear that the control of schistosomiasis can be achieved only through destruction of the snails, and the nationwide elimination of the snail host is as essential for the eradication of schistosomiasis as is nationwide elimination of anopheline vectors for eradication of malaria. This goal in schistosomiasis control is not yet in sight.

Trypanosomiasis

Sleeping sickness, caused by infection with certain species of trypanosomes, is endemic in parts of tropical Africa, conforming to the distribution of the tsetse fly vectors. However, the distribution of the disease is so extensive and its effects so serious that they transcend national and international boundaries. Despite the fact that Africa has great potentialities for agricultural development, millions of square miles of her cultivable land today lie idle and uninhabited because of trypanosomiasis. The disease has depopulated villages and driven people out of fertile river regions to areas uninhabited by tsetse flies. In conse-

quence these tsetse-free areas have become overpopulated with the resultant loss of soil fertility.

In endemic zones the disease is usually mild and chronic in nature, with some spontaneous cures. When, however, as a result of an expansion of trade or an increase of travel, the disease is introduced into a region in which it did not previously exist, it may produce devastating epidemics.

Other forms of trypanosomiasis occur in animals. Up to 50 per cent of the wild antelopes of Africa harbor trypanosomes, but these animals show no signs of disease. From them the infection is easily transmitted by appropriate species of tsetse flies to domestic animals, in which it causes a high rate of mortality. Its destructive effects are not limited directly to the livestock. In large areas there is a dearth of milk and meat, both vital to the nutrition of the people. Not only does agriculture suffer from lack of manure to fertilize the soil, but also, without draft animals, methods of farming remain primitive.

Some measure of control of human trypanosomes has been achieved by means of mass treatment with specific drugs. Chemoprophylaxis has given encouraging results when applied to small communities which are particularly exposed to infection, such as mining camps and labor forces, but at present it cannot be used economically for large population groups.

Tsetse flies have been eliminated or controlled by different methods in various areas through the intensive application of insecticides, selective clearing of vegetation and the trapping of adult flies. Destruction of game has been practiced to reduce the reservoir of infection for cattle. Some of the methods used are costly and others are of limited value. Thus far it has been impossible to eradicate human trypanosomiasis from any locality.

Arguments are often advanced that the promotion of public health measures, by lowering the death rate, will inevitably serve to upset the equilibrium of natural forces and increase the population pressures in the areas concerned. Such reasoning appears to be justified from a short-term point of view, but it implies callous disregard for the welfare of humanity, which is inconsistent with our modern philosophy. From the standpoint of economics, it is also open to question. Nations with low standards of health maintain low levels of production. Suffering from poverty and disease, they are unable to contribute their fair share to the world's economy. Moreover, they are susceptible to serious regional food shortages resulting from the vagaries of nature, which in their retarded state of development they are quite unprepared to meet.

Interwoven with the humanitarian and economic aspects are political factors which seem more important today than ever before. International friendship and peace may be fostered by reinforcing the social and economic strength of the individual governments—by helping people to solve their own problems and to assume responsibility for their own welfare. This implies a threefold approach—through improvements in public health, in agriculture and in education. No single approach is adequate in itself, but together they offer a greater measure of prosperity and stability. By broadening the base of the educated, healthy and well fed individuals in the countries throughout the world, we enlarge the opportunities for peace and minimize the threat of subversive influence.

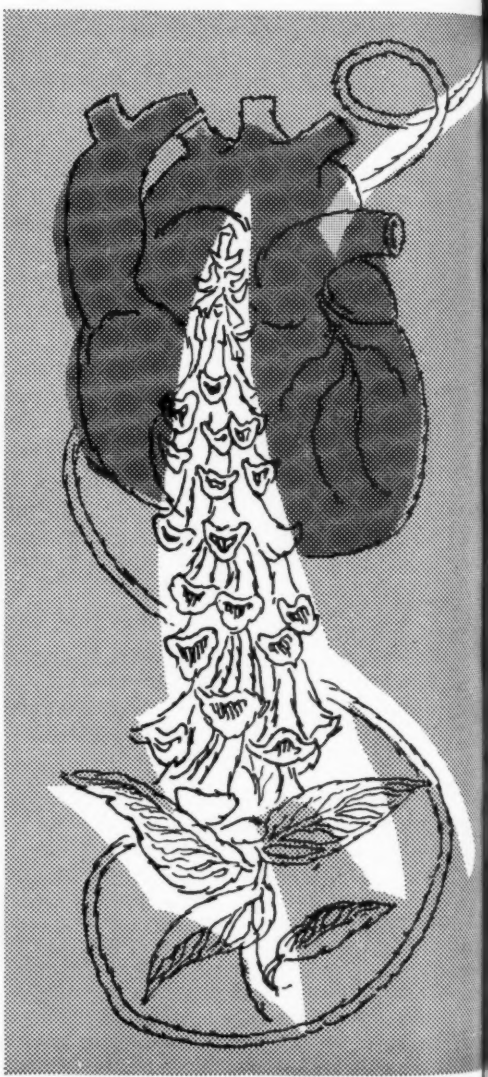
REFERENCES

1. Russell, P. F.: The present status of malaria in the world. J. Trop. Med. 1:111-123 (January) 1952.
2. Who's News. WHO Newsletter, No. 11-12:4 (November-December) 1950.
3. Africa Looks to the Future. WHO Newsletter, No. 2:4 (February) 1951.
4. Stoll, N. R.: This wormy world. J. Parasitol. 33:1-18 (February) 1947.
5. Wright, W. H.: Medical parasitology in a changing world. What of the future? J. Parasitol. 37:11 (February) 1951.
6. McMullen, D. B. and Graham, O. H.: The control of schistosomiasis japonica. II. Studies on the control of *Oncomelania quadrasi*, the molluscan intermediate host of *Schistosoma japonicum* in the Philippine Islands. Am. J. Hyg. 45:274-293 (May) 1947.
7. McMullen, D. B., Komiyama, S., Ishii, N., Endo-Itabashi, T., Ozawa, K., Asakawa, T. and Mitoma, Y.: The use of molluscacides in the control of *Oncomelania nosophora*, an intermediate host of *Schistosoma japonicum*. Am. J. Trop. Med. 31:593-604 (September) 1951.
8. Kuntz, R. E. and Wells, W. H.: Laboratory and field evaluations of two dinitrophenols as molluscacides for control of schistosome vectors in Egypt, with emphasis on importance of temperature. Am. J. Trop. Med. 31:784-824 (November) 1951.

Therapy of the Failing Heart

G. F. SCHMITT

Miami, Florida



Basic Principles

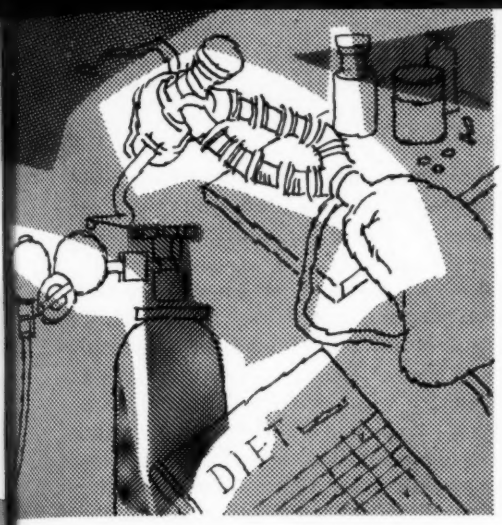
BODY water is divided into intracellular and extracellular compartments. The principal cation of the former is potassium; of the latter, sodium. Sodium is fixed in the extracellular space and does not traverse the cell membrane. The major shifts of water occur when sodium (not potassium) is retained or excreted; hence the principal aim of therapy is to prevent the retention of abnormal amounts of sodium with a consequent holding of large quantities of water.

Food is the only source of sodium, and a low sodium diet decreases the availability of the ion. Sodium-binding resins absorb about 50 per cent of ingested sodium.

The glomerulus filters water and crystalloids. As the filtrate passes through the tubules, certain high threshold bodies (water, sugar, sodium and potassium) are reabsorbed selectively, and low threshold bodies rejected. A mercurial diuretic transiently paralyzes the tubular cells and consequently, temporarily, even the high threshold bodies are lost. The loss of water and sodium reflects itself in the draining of the extracellular reservoir.

The digitalis principles are used to improve the ability of the heart to function as a pump, enhancing the circulation of the kidney, thus increasing its ability to rid the body of sodium.

Other measures prevent complications, or are for symptomatic relief.



Oxygen Therapy

The value of oxygen therapy lies in the increase of oxygen in the blood stream. Under normal conditions, at sea level, the atmospheric pressure is 760 mm. of mercury of which 47 mm. is water vapor. The partial pressure of oxygen in inspired air is 158 mm.; in expired air, 116 mm., and in alveolar air, 103 mm. The rate of oxygen absorption from the pulmonary epithelium by the blood is directly proportional to the partial pressure of the oxygen. If the percentage of oxygen in a mixture is raised with the atmospheric pressure remaining the same, the partial pressure of oxygen is increased, and hence more oxygen is forced across the alveolar membrane. The effectiveness of oxygen therapy is related only to the effectual concentration of the oxygen—not to the type of device used.

The chief indications for oxygen therapy are dyspnea, cyanosis, periodic breathing, rising heart rate and certain arrhythmias.

Oxygen tanks vary in size as follows:

TYPE	DIMENSIONS *(inches)*	WEIGHT *(pounds)*	GALLONS
D	4.5 by 20	12	95
E	4.5 by 30	15	165
K	9.5 by 55.5	150	1830

TYPE	CUBIC FEET	LITERS	WEIGHT GAS *(pounds)*
D	12.7	359	1.062
E	22	654	1.828
K	244	6900	21.7

There is economy in using the larger tank.

The number of hours a K cylinder (244 cubic feet) will last at varying rates of flow follows:

LITERS	HOURS
2	57.5
4	28.75
8	14.25
12	9.5

A simple, practical method to calculate the length of time a tank of oxygen will last is to multiply the pressure by 3 and divide the product by the rate of flow per minute. The quotient is the length of time (in minutes) the tank will last.

All oxygen is the same; there is no such thing as medicinal oxygen. However, tanks used in the sick room are better cared for than tanks used commercially. Tanks containing oxygen are usually painted green.

The Gauge

The function of the gauge is to reduce the pressure of the oxygen in the cylinder to that of the relatively low pressure in the tubing. Gauges are of two types: single and two stage. The two stage gauge reduces the pressure in two steps, one of which is constant and the other variable. In this way the high cylinder pressure is prevented from straining the delicate mechanism of the second stage. In the single stage regulator, pressure reduction and control are accomplished by a single variable mechanism. The former type is the better.

The gauge nearest the tank measures the pressure in the tank, and the second gauge measures the rate of flow. There are two forms of the latter: Bourdon and Thorpe. The Bourdon type contains a hollow circular tube with segment missing. Pressure straightens the tube, the degree of which is recorded (on a dial). It may be used in any position, but has the disadvantage that even if the tube is obstructed, it measures the same flow. The Thorpe form consists of a tapered transparent tube with a ball which rises or falls in proportion to the flow of gas. It must always be

in the vertical position. The actual flow of gas is indicated, and the gauge is accurate at very low rates.

With certain devices, it is necessary to moisten the air to prevent excessive drying of mucous membrane. An ordinary wash bottle is usually sufficient, but a humidifier which breaks up the oxygen and water into fine spray is better.

Catheters

A soft rubber urethral catheter inserted into the nasopharynx is the simplest, but least effective, method for the administration of oxygen. A lubricated No. 10 (never more than No. 12) French catheter perforated with six holes is passed along the floor of the nose until it reaches the posterior pharynx. It is then slightly withdrawn, and kept in position by adhesive applied to the catheter over the nose and forehead. A metal cannula, substituted for the catheter, is somewhat more comfortable because it reduces stimulation of the mucosa.

The oropharyngeal placement is more efficient because of the relatively larger space in which oxygen can accumulate. The catheter is inserted until the patient swallows oxygen. The distance between the external nares and the catheter tip is 4.5 to 5.5 inches. When viewed from the mouth, the catheter point is at the tip of the uvula. Catheters must be changed every 12 hours.

Masks

The BLB mask is simple, inexpensive and practical. The mask is of the partially rebreathing type: The first third of the expired air is collected in the bag. There are two types, nasal and oronasal, of which the latter is better.

The O. E. M., meter, or Barach mask is of the semi-demand type. Oxygen flows into the bag and is inspired through the inspiratory valve as needed. On expiration the gases pass out through a flutter valve. There is no rebreathing. Even with low flows, the carbon dioxide does not rise above 0.2 per cent. A concentration meter delivers the desired percentage of oxygen. Some models have a compartment in which water may be placed, eliminating the necessity for a humidifier. The mask comes in the nasal and the oronasal form. It can be fitted with a device for administering oxygen under positive pressure. This consists of a series of apertures which are smaller than the diameter of the larynx. When expiration takes place through a constricted orifice, the positive pressure is reflected back into the lung, the amount of the pressure being determined by the size of the orifice.

In administering oxygen by mask, the mask should be removed every two hours and the face washed, dried and powdered.

A comparison of the rates of flow and concentrations in an average-sized man with the devices already listed follows:

DEVICE	OXYGEN FLOW	CONCENTRATION *(per cent)*
Single cannula	6-8	30
Double cannula	6-8	35
Nasocatheter	2	28
Nasocatheter	4	33
Nasocatheter	5	36
Nasocatheter	6	38
Nasocatheter	8	42
Oropharyngeal	5	35
Oropharyngeal	6	45
Oropharyngeal	7	50
BLB	3	40-50
BLB	4	55-70
BLB	5	70-80
BLB	6	80-90
BLB	7	90-100

With the latter two methods in larger pa-

tients, it is necessary to increase the rate of flow by 1 liter per minute to obtain the desired percentage.

A convenient way to remember the rate of flow necessary is to recall that the concentration is increased above room concentration by about 4 per cent for each liter per minute increase in flow.

The oxygen tent is employed to administer oxygen in concentrations between 40 and 60 per cent, at a temperature of 70° F. and a humidity of 40 to 60 per cent. The tent must be thoroughly tucked in; a rubber sheet is not necessary. Tents usually differ in their cooling mechanism, utilizing ice, dry ice or mechanical refrigeration. The last is the most practicable, and late models have most of the mechanism under the bed. All are equipped with motor blowers.

A special type of tent is termed a thermal circulation and, having no blower, utilizes the principles of convection. All tents must be checked at least three times daily with an analyzer to ascertain if the oxygen concentration is that prescribed. A flow of 8 to 10 liters per minute is necessary to prevent the rise of carbon dioxide.

A special type of canopy is termed the open box. The top is completely open, and closure is made at the neck. With a flow of 7 to 10 liters per minute, an oxygen concentration of 50 per cent can be obtained at the patient's nose. The open box type is especially desirable in infants and children.

Oxygen chambers and rooms are excellent ways to produce an oxygen-enriched atmosphere but are expensive and for the most part impracticable.

Low Sodium Diet

FOODS ALLOWED

(approximately 250 mg.)

Meat or fish—5 ounces
Chicken, lamb, veal, beef, venison, rabbit, duck, turkey, quail, bass, cod, halibut, trout

Fats—as desired
Salt-free butter; unsalted shortening as SPRY®; CRISCO®; salad oils; corn, olive or peanut oil

Egg—one

Vegetables—fresh or frozen only, 2 servings (½ cup each)
Asparagus, avocado, green beans, lima beans, broccoli, Brussels sprouts, cabbage, carrots, cauliflower, corn, cucumber, eggplant, endive, lettuce, mushrooms, okra, onions, parsley, parsnips, peas, radishes, squash, tomatoes, turnips

Starches—2 servings (½ cup each)
Potatoes (sweet or white), rice, macaroni, grits, noodles, spaghetti

Fruits—3 servings (½ cup each)
Apples, apricots, bananas, blackberries, cantaloup, cherries, coconut, cranberries, currants, figs, fruit cocktail, gooseberries, grapes, grapefruit, honeydew melon, lemons, oranges, peaches, pears, pineapple, raspberries, plums, rhubarb, strawberries, blueberries, tangerines, watermelon

Cereals—1 serving (½ cup)
Any cooked, unsalted cereal or PUFFED WHEAT®, PUFFED RICE® or SHREDDED WHEAT®

Bread—4 slices
Yeast bread made without salt, baking powder or soda

Seasonings and flavorings—moderately
Allspice, caraway, cinnamon, curry powder, garlic, mace, mustard powder, nutmeg, paprika, pepper, sage, salad dressings (salt-free), vanilla extract, thyme, tumeric, vinegar

Desserts; Sweets; Nuts—moderately within caloric limit
Brown Betty, candies (hard), cornstarch pudding (low sodium milk), fruits (candied), honey, ice cream (low sodium milk), ices made with fruit juices, pies (fruit—unsalted crust), sponge cake, tapioca; jam, jelly, maple syrup, marmalade; almonds, brazil, cashew, pecans, chestnuts, filberts, peanuts

Beverages—as allowed within fluid allowance
COCA-COLA®, coffee, fruit juices, ginger ale, KOOL-AID®, lemonade, milk (dialyzed), tea

Salt substitutes
CO-SALT®, gustamate, diasal, NEOCURTASAL®

Resins
Natrinil, RESODEC®, carbo-resin

Meat contains a large amount of sodium and must be restricted. Dried, pickled, salted and smoked meat is forbidden.

Butter must be unsalted. No hard cheeses are permitted.

Eggs are high in sodium and are limited to one a day.

Canned vegetables contain salt; hence vegetables must be fresh or frozen. Certain vegetables—beets, celery, sauerkraut, spinach—are high in sodium.

Fruit may be canned, fresh or frozen but must not contain added sodium.

Most prepared cereals are highly salted, particularly corn flakes, ALL-BRAN®, and rice and wheat flakes.

Bread must be prepared without salt. UNEEDA® biscuit and certain types of matzo are salt-free.

Only those desserts prepared without baking powder, baking soda or salt are permitted. Black-strap molasses is high in sodium.

Certain medicines, like aspirin, are high in sodium.

Cation exchange resins (resodec, natrinil, carbo-resin) permit a more liberal intake of sodium. Given in 15 gm. doses before meals, they absorb the sodium ion in the digestive tract. In general they absorb about 50 per cent of the ingested sodium. The resins are fairly expensive.

Cardiotonic Principles

1. Digitalis (U.S.P.) is the dried leaf of *Digitalis purpurea* (family *Scrophulariaceae*). The potency of digitalis is such that, when assayed as directed, 0.1 gm. shall be equivalent to not less than 1.0 U.S.P. digitalis unit. One U.S.P. unit represents the potency of 0.1 gm. of the U.S.P. Digitalis Reference Standard. When digitalis is prescribed, powdered digitalis is to be dispensed. Digitalis, dried at a temperature not exceeding 60°, reduced to a fine or very fine powder, and adjusted, when necessary, to conform to the official potency by admixture with sufficient lactose, starch or exhausted marc of digitalis or with a powdered digitalis having either a higher or a lower potency. Powdered digitalis contains not more than 5 per cent moisture.

2. Digitalis lanata is the dried leaf of *Digitalis lanata* (family *Scrophulariaceae*). It is not official.

3. Strophanthus gratus is the dried seed of *Strophanthus gratus*. It is not official.

4. Strophanthus (N.F.) is the dried ripe seed of *Strophanthus kombé* or of *Strophanthus hispidus* (family *Apocyanaceae*) deprived of the awn. Strophanthus possesses a potency per gram equivalent to not less than 55.0 mg. of U.S.P. Reference Ouabain.

5. Squill consists of the cut and dried fleshy inner scales of the bulb of the white variety of *Urginea maritima*, known in commerce as the white or Mediterranean squill, or of *Urginea indica*, known in commerce as Indian squill.

6. Digitalis Capsules and Tablets (U.S.P.) contain the labeled amounts of powdered digitalis. They vary in weight from 0.032 gm. (½ gr.) to 0.097 gm. (1½ gr.) and in strength from ⅓ U.S.P. unit to 1 U.S.P. unit. The weight is not necessarily related to the strength.

7. Digitalis Injection (U.S.P.) is a sterile solution in water for injection of a mixture of glycosides or therapeutically desirable and cardioactive constituents of digitalis. Its potency is to be indicated on the label in terms of U.S.P. digitalis units. Digitalis Injection may contain not more than 10 per cent of alcohol as a preservative. Usually, each ampule contains 2 cc. and each cubic centimeter contains ⅓ U.S.P. digitalis unit.

8. Digitalis Tincture (U.S.P.). Potency shall be such that when assayed as directed, 1 cc. of the tincture shall be equivalent to 1.0 U.S.P. digitalis unit. The approximate alcohol content is 73 per cent.

9. Digitalis Extract (N.F.), when assayed by the prescribed method, possesses a potency such that 100 mg. of it is equivalent to 3 U.S.P. digitalis units. One gram of the extract represents 3 gm. of powdered digitalis.

10. DIGALEN® (N.N.R.) contains the cardioactive principles of digitalis as isolated by Cloetta. The process of preparation is described in N.N.R., page 227.

Solution: Each cubic centimeter contains 1 U.S.P. unit.

Solution (injection): Each 2 cc. contains 1 U.S.P. unit.

Tablets: ½ and 1 U.S.P. unit. N.B.: This strength of the preparation has been recently increased about 25 per cent from 1 cat unit to 1 U.S.P. unit.

11. DIGIFOLIN® (N.N.R.) is a digitalis preparation containing the therapeutically desirable constituents of digitalis leaf. The process of preparation is described in N.N.R., page 228.

Solution: Each cubic centimeter contains the preparation equivalent to 0.1 gm., 1 U.S.P. unit, of digitalis leaves. It contains 12 per cent alcohol.

Solution (injection): 2 cc. ampules. Each cubic centimeter contains the preparation equivalent to 0.1 gm., 1 U.S.P. unit, of digitalis leaves. The solution contains 8 per cent ethyl alcohol as a stabilizer.

Tablets: Each tablet contains the preparation equivalent to 0.1 gm., 1 U.S.P. unit, of digitalis leaves.

12. DIGIFORTIS® is an extract of *Digitalis purpurea*.

Capsule: 1 U.S.P. unit.

Solution: Each cubic centimeter represents ¼ U.S.P. unit.

Solution (injection): Each cubic centimeter contains 1 U.S.P. unit.

Tablets: ½ and 1 U.S.P. unit.

13. DIGIGLUSIN® is a mixture of digitalis glycosides.

Solution: Each cubic centimeter contains 1 U.S.P. unit.

Solution (injection): Each cubic centimeter contains 1 U.S.P. unit.

Tablets: ½, 1 and 1½ U.S.P. units.

14. Digitalin Potent is a powdered preparation from digitalis with a potency 10 times that of digitalis leaves.

15. Digitoxin (U.S.P.) is either pure digitoxin ($C_{41}H_{64}O_{13}$) or a mixture of cardioactive glycosides obtained from *Digitalis purpurea* Linné (family *Scrophulariaceae*). When assayed, it has a purity of 95 per cent. Digitoxin Tablets (U.S.P.) contain not less than 90 per cent and not more than 110 per cent of the labeled amount of digitoxin. Digitoxin Injection (U.S.P.) is a sterile solution of digitoxin in 40 to 50 per cent alcohol. Glycerin may also be present. It contains not less than 90 per cent and not more than 110 per cent of the labeled amount of digitoxin. Digitoxin has the potency approximately 1000 times that of the digitalis leaf. It is

marketed under various trade names by many pharmaceutical houses. There is no advantage in prescribing trade name; all must conform to pharmacopoeial standards.

Capsules in oil: 0.1, 0.2 mg.

Solution: 0.2 mg. per cubic centimeter in 1 cc. ampules and 10 cc. ampules.

Tablets: 0.05, 0.5, 0.15, 0.2 mg.

16. Gitalin (N.N.R.) is a glycosidal constituent of *Digitalis purpurea* prepared according to the method of Kraft. The method of preparation is described in N.N.R., page 234.

Tablets: 0.5 mg.

17. Digoxin (U.S.P.) is a glycoside obtained from the leaves of *Digitalis lanata* Ehrh. (family *Scrophulariaceae*). Digoxin Tablets (U.S.P.) contain not less than 90 per cent and not more than 110 per cent of the labeled amounts of digoxin. Digoxin Injection (U.S.P.) is a sterile solution of digoxin in 70 per cent alcohol. It contains not less than 90 per cent and not more than 110 per cent of the labeled amount of digoxin.

Solution (injection): 0.05 per cent: 1 cc. ampules contain 0.5 mg. of digoxin per cubic centimeter in 70 per cent alcohol solution.

Tablets: 0.25 mg.

18. DIGILANID® (N.N.R.) is a mixture of isomorphous crystallized cardioactive glycosides—lanatoside A ($C_{49}H_{76}O_{19}$), lanatoside B ($C_{46}H_{76}O_{20}$) and lanatoside C ($C_{49}H_{76}O_{20}$)—obtained from the leaves of *Digitalis lanata*. The three components are present in the mixture in which they occur in the crude drug, namely, about 47 per cent lanatoside A, 16 per cent lanatoside B and 37 per cent lanatoside C. For preparation see N.N.R., page 229.

Solution: 30 cc. vials. Each cubic centimeter contains 0.333 mg. of the glycosidal mixture.

Solution (injection): 2 cc. and 4 cc. ampules. (For intramuscular and intravenous use.) Each 2 cc. contains 0.4 mg. (1.2 cat units) of the glycosidal mixture, alcohol 7.5 per cent by weight and glycerin 15 per cent by weight.

Suppositories: 0.5 mg. (1½ cat units).

Tablets: 0.333 mg. (1 cat unit).

N.B.: One cat unit equals 0.8 U.S.P. unit.

19. Lanatoside C (U.S.P.) is a glycoside obtained from the leaves of *Digitalis lanata* Ehrh. (family *Scrophulariaceae*). Lanatoside C Injection is a sterile solution of lanatoside C in 10 per cent, by volume, of alcohol. Glycerin may also be present. The injection contains in each cubic centimeter the labeled amount of $C_{49}H_{76}O_{20}$. Lanatoside C Tablets contain the labeled amount of $C_{49}H_{76}O_{20}$.

Solution (injection): 2 cc. and 4 cc. ampules. Each 2 cc. contains lanatoside C, 0.4 mg. (1.6 cat units), alcohol 8 per cent and glycerin 15 per cent. Vial (30 cc.): Each cubic centimeter contains 1 mg.

Tablets: 0.5 mg.

20. Ouabain (U.S.P.) is a glycoside obtained from the seeds of *Strophanthus gratus* and from the wood of *Acocanthera schimperi* (family *Apocyanaceae*). Ouabain Injection is a sterile solution of ouabain in water for injection. The injection contains in each cubic centimeter the labeled amount of $C_{29}H_{44}O_{12}\ 8H_2O$.

Solution (injection): 1 cc. and 2 cc.; each cubic centimeter contains 0.00025 gm.; 0.5 cc. contains 0.0001 gm.

21. Strophanthin (N.F.) is a glycoside or a mixture of glycosides obtained from *Strophanthus kombé* Oliv. (family *Apocyanaceae*). When assayed as directed, strophanthin possesses a potency per milligram equivalent to 0.5 mg. of U.S.P. Ouabain Reference Standard. Strophanthin Injection is a sterile solution of strophanthin in water for injection. Its potency shall be stated on the label of the container in terms of the quantity of U.S.P. Ouabain Reference Standard to which it is equivalent.

Solution (injection): 2 cc. ampules—each 2 cc. contains 0.68 mg. strophanthin. 1 cc. ampules—each cubic centimeter contains 0.65 mg.

Tablets: 0.13 mg.

22. K-Strophanthin is a glycoside derived from *Strophanthin kombé*.

Solution (injection): 0.5 cc. and 1 cc. Each 0.5 cc. contains 0.25 mg. of K-Strophanthin.

23. SCILLAREN® (N.N.R.) is a mixture of two natural glycosides (component A and component B) occurring in fresh squill, *Urginea maritima*, in the proportions in which they exist in the crude drug, namely, about 2 parts of A to 1 part of B. The completely dried preparation contains approximately 98 per cent of the active glycosides. One cat unit equals 0.181 mg. of scillaren A and 0.144 mg. of scillaren B. One cat unit equals 0.8 U.S.P. unit. Scillaren A and scillaren B are rapidly eliminated so the above is not directly comparable.

Solution: Each cubic centimeter contains 0.0008 gm. (4.4 cat units).

Suppositories: Each suppository contains 0.001 gm.

Tablets: 0.0008 gm. (4.4 cat units).

24. Scillaren B (N.N.R.) is the amorphous component of the natural mixture of the glycosides occurring in squill, *Urginea maritima*. The completely dried component B contains approximately 99.5 per cent active glycosidal substance.

Solution (injection): 1 cc. ampules. Each cubic centimeter contains 0.0005 gm. (3.4 cat units).

The United States Pharmacopoeial Convention, American Pharmaceutical Association, and the Council on Pharmacy and Chemistry of the American Medical Association have given permission to use excerpts from *The United States Pharmacopoeia, National Formulary*, and *New and Nonofficial Remedies*, respectively. They are not responsible for inaccuracies.

Diuretics

1. Mersalyl and Theophylline Injection U.S.P. (SALYGRAN-THEOPHYLLINE®, mercophyl) is a sterile solution in water for injection of approximately 2 parts by weight of mersalyl ($C_{13}H_{18}HgNNaO_6$) to each 1 part by weight

of theophylline ($C_7H_8N_4O_2H_2O$). Each cubic centimeter represents 100 mg. of mersalyl equivalent to 39.6 mg. of mercury and 50 mg. of theophylline.

Solution (injection): 1 cc. and 2 cc. ampules; 1 cc. AMPINS®.

2. Mercurophylline Injection (U.S.P.) (MERCUZANTHIN®; MERCUPURIN®) is a sterile solution of mercurophylline in water for injection. Mercurophylline is in approximately molecular proportions containing 10 parts by weight of organic mercury compound to 4 parts by weight of theophylline. Each cubic centimeter represents 135 mg. of the salt equivalent to 39 mg. of mercury and 35 mg. of anhydrous theophylline.

Solution (injection): 1.1 cc. and 2.2 cc. ampules.

Note: The solution made by Flint, Eaton and Company contains 150 mg. of mercurophylline per cubic centimeter. The solution made by Kremers-Urban contains 62 mg. of mercurophylline per cubic centimeter in a 5 cc. ampule; and 155 mg. of mercurophylline per cubic centimeter in a 2 cc. ampule. The latter also contains benzyl alcohol, 2 per cent, to lessen pain of intramuscular injection.

3. Meralluride Injection (U.S.P.) (MERCUHYDRIN®) is a sterile solution of meralluride in water for injection made by the addition of just sufficient sodium hydroxide solution to effect solution of the meralluride. Meralluride consists of the mercury compound ($C_9H_{16}HgN_2O_6$) and of theophylline in approximately molecular proportions. Each cubic centimeter contains 176 mg. of meralluride equivalent to 39 mg. of mercury and 48 mg. of theophylline.

Solution (injection): 1 cc. and 2 cc. ampules; 10 cc. vials.

4. Mercaptomerin (THIOMERIN®). Each cubic centimeter represents 140 mg. of disodium salt or N-(γ-carboxymethylmercaptomercuri-β-methoxy) propylcamphoramic acid equivalent to 40 mg. of mercury. It is the same as mercurophylline except that the theophylline portion is replaced by a monosulfhydryl group. The mercury-bearing portion is the same as the two compounds.

Solution (injection): 10 and 30 cc. vials.

5. Mercumatilin (CUMERTILIN®) is 8-(β-hydroxymercuri-γ-methoxypropyl)-3-carboxycoumarin theophylline). Each cubic centimeter contains 132 mg. of the compound of which 93 mg. is mercumallylic acid equivalent to approximately 39 mg. of mercury. The theophylline content is approximately 50 mg. per cubic centimeter, of which 11 mg. is excess theophylline.

Solution (injection): 1 cc. ampules.

6. Mersalyl and Theophylline (salyrgan-theophylline) Tablet contains 80 mg. of mersalyl, equivalent to 31.7 mg. of mercury, and 40 mg. of theophylline.

7. Mercurophylline (mercuzanthin; mercupurin) Tablet contains the concentrate of 0.74 cc. mercurophylline injection equivalent to 30 mg. of mercury and 27 mg. of anhydrous theophylline.

8. Meralluride (mercuhydrin with ascorbic acid) Tablet equivalent to 19.5 mg. of mercury, 19.25 of theophylline monohydrate and 100 mg. of ascorbic acid.

9. Mercurophylline with Ascorbic Acid (mercurascorb) Tablet contains 74 mg. of mercurophylline equivalent to 30 mg. of mercury, 29 mg. of theophylline and 100 mg. of ascorbic acid.

10. Mercurital tablet contains 60 mg. of mersalyl, equivalent to 24 mg. of mercury, and theobromine calcium.

11. Ammonium Chloride (U.S.P.) when dried over sulfuric acid for four hours contains not less than 99.5 per cent of NH_4Cl.

Tablets: 0.5 gm.

12. Ammonium Nitrate contains not less than 99 per cent of NH_4NO_3.

Tablets: 0.5 gm.

13. Potassium Nitrate (U.S.P.) dried at 105° for four hours contains not less than 99 per cent of KNO_3.

Tablets: 0.5 gm.

14. Theobromine Calcium Salicylate (U.S.P.) (theocalcin) is a double salt of complex in molecular proportions of theobromine calcium ($C_{14}H_{14}CaN_8O_4$) and calcium salicylate ($C_{14}H_{10}CaO_6$).

Tablets: 0.5 mg.

15. Theobromine and Sodium Acetate (U.S.P.) is a hydrated mixture of theobromine sodium ($C_7H_7N_4O_2Na$) and sodium acetate ($NaC_2H_3O_2$) in approximately molecular proportions.

Capsules: 0.244 gm. and 0.486 gm.

Tablets: 0.25 gm. and 0.486 gm.

16. Theobromine Sodium Salicylate (N.F.) (diuretin) is a mixture of $NaC_7H_7N_4O_2$ and $C_7H_5NaO_3$ in approximately molecular proportions.

17. Theobromine and Calcium Gluconate is a double compound of theobromine and calcium gluconate combined in equimolecular proportions.

Tablets: 0.486 mg.

18. Aminophylline (U.S.P.) contains not less than 75 per cent and not more than 82 per cent of anhydrous theophylline ($C_7H_8N_4O_2$) and not less than 12.3 per cent and not more than 13.8 per cent of ethylenediamine ($C_2H_4[NH_2]_2$). Aminophylline Injection is a sterile solution of aminophylline in water for injection. For the purpose of stabilization, aminophylline injection may contain ethylenediamine amounting to not more than 60 mg. of $C_2H_4(NH_2)_2$ for each gram of aminophylline.

Solution (injection): 500 mg. in 20 cc. and 2 cc., 250 mg. in 10 cc.

Suppositories: 0.5 gm.

Tablets: 0.097 gm.; 0.194 gm.

19. Theophylline and Sodium Acetate (N.F.) (THEOCIN® Soluble; THEACITIN®) is a hydrated mixture of theophylline sodium and sodium acetate ($C_2H_3NaO_2$) in approximately molecular proportions.

20. Theophylline-Methylglucamine (N.N.R.) (glucophyllin) is an equimolecular mixture of theophylline ($C_7H_8N_4O_2 \cdot H_2O$) and methylglucamine ($C_7H_{17}NO_5$).

Solution (injection): 0.366 gm. in 10 cc. ampules and 0.732 gm. in 2 cc. and 20 cc. ampules.

Suppositories: 0.5 gm.

Tablets: 0.15 gm. and 0.3 gm.

21. Theophylline-Sodium Glycinate (N.N.R.) (GLYNAZAN®, glytheonate, SYNOPHYLATE®, THEOGLYCINATE®) contains slightly more than 2 moles of sodium glycinate to 1 mole of theophylline.

Elixir: 0.26 gm. per 4 cc.

Suppositories: 0.78 gm.

Syrup: 0.13 gm. per 4 cc.; 0.33 gm. per 4 cc.

Tablets: 0.162 gm.; 0.35 gm.

22. Theophylline Calcium Salicylate (phyllicin) is a double salt of theophylline and calcium salicylate.

Tablets: 0.266 gm.

23. Theophylline Monoethanolamine (MONOTHEAMIN®) is a double salt of theophylline and monoethanolamine ($NH_2 \cdot CH_2 \cdot CH_2OH$).

Capsules: 0.1 gm.

RELATIONS OF GLYCOSIDES

DIGITALIS PURPUREA				DIGITALIS LANATA
Native Glycoside	*Glycoside*	*Aglycone*	*Glycoside*	*Native Glycoside*
Deacetyllanatoside A →	Digitoxin →	Digitoxigenin ←	Digitoxin ←	Lanatoside A
Deacetyllanatoside B →	Gitoxin →	Gitoxigenin ←	Gitoxin ←	Lanatoside B
Glycoside (?) →	Gitalin →	Gitaligenin		
		Digoxigenin ←	Digoxin ←	Lanatoside C (Stoll)

SOURCES OF CARDIOTONIC PRINCIPLES

SOURCE	PRINCIPLE	
Digitalis purpurea	Deacetyllanatoside A (Digitoxin) Deacetyllanatoside B (Gitoxin) Glycoside (?) (Gitalin)	
Digitalis lanata	Lanatoside A (47 per cent) (Digitoxin) Lanatoside B (16 per cent) (Gitoxin) Lanatoside C (37 per cent) (Digoxin)	Digilanid
Strophanthus gratus	Ouabain (G-Strophanthin)	
Strophanthus kombé	Strophanthin K-Strophanthin	
Urginea maritima	Scillaren A and B	

DIGITALIZATION

PREPARATION	INITIAL DOSE INTRAVENOUSLY, MG.	SUBSEQUENT DOSE INTRAVENOUSLY, MG.	INTERVAL, HOURS	DIGITALIZING DOSE INTRAVENOUSLY, MG.	SPEED INTRAVENOUSLY, HOURS
Leaf					
Digitoxin	0.8	0.2-0.4	6	1.0-3.0 (1.6)	6
Digoxin	0.5-1.0	0.25	6	0.75-2.0	1-2
Digilanid	0.8	0.8	24	3.0-6.0	2-6
Lanatoside C	1.0-1.6	0.4	6	1.0-2.0 (1.6)	1-2
Ouabain (G-Strophanthin)	0.5	0.1	1	0.5-1.0	1
Strophanthin	0.3-0.5	0.1	1	0.5-1.0	1
K-Strophanthin	0.3	0.1	1	0.5-1.0	1
Scillaren					
Scillaren B	0.25	0.375	24	1.2	1
Gitalin					

DIGITALIZATION

Indications

Impending or actual heart failure—irrespective of underlying heart disease, age of patient, precipitating factors, type of rhythm, heart rate or presence of block

Contraindications

Digitalis toxicity

In absence of cardiac failure, one does not digitalize in

- Ventricular tachycardia
- Myocardial infarction
- Acute toxemias—pneumonia
- Peripheral shock
- Routine preoperative administration
- Tonic

INDICATIONS FOR INTRAVENOUS THERAPY

1. Complications which render oral administration impracticable
2. Certain cardiac arrhythmias, including auricular fibrillation and auricular flutter, with or without congestive failure, and auricular tachycardia
3. Patients with impending or actual heart failure or with arrhythmias, when emergency operations are necessary
4. Acute left ventricular failure

SIGNS OF DIGITALIS INTOXICATION

Gastrointestinal

- Anorexia
- Nausea
- Vomiting
- Diarrhea

Cardiologic

- Premature ventricular beats
- Slow coupled beat
- Partial or complete block
- Paroxysmal tachycardia
- Auricular or ventricular fibrillation
- Auricular standstill

Neurologic

- Headache
- Restlessness
- Increased irritability
- Disorientation
- Changes in personality
- Stupor

Visual

- Dimness

DIGITALIZATION

GASTROINTESTINAL ABSORPTION, PER CENT	INITIAL DOSE—ORAL, MG.	SUBSEQUENT DOSE—ORAL, 6 HOUR INTERVAL, MG.	DIGITALIZING DOSE—ORAL, MG.	MAINTENANCE DOSE—ORAL—DAILY, MG.	DAILY TOXICITY RANGE, MG.	DURATION OF ACTION, DAYS
20	400-800	200-400	1000-2000	100-200	200-300	14-21
100	0.8	0.2-0.4	1.0-3.0 (1.6)	0.1-0.2	0.2-0.3	14-21
50	1.0-1.5	0.5-0.75	2.0-5.0 (3.75)	0.5-0.75	1.0	5-7
20	1.32-2.64	0.66-1.32	3.0-8.0	0.33	0.66-0.99	5-21
10	1.5-3.0	0.75-1.5	10-20	0.5-1.0	1.5-2.0	2-10
0	0					1-4
0						1-4
0						1-2
5	4.8-6.4	1.2-1.6	15-30	0.8-0.24	1.5	1-2
						1-2
100	1.5-2.5	0.75	3.0-10.5 (5.5)	0.25-1.25 (0.5)	0.75-3.0 (1.2)	9-12

Inability to focus
Scotomas
Diplopia
Yellowish, greenish tinting

ADVANTAGES OF CARDIAC GLYCOSIDES

1. Digitalis leaf contains a mixture of glycosides of unknown proportions
2. No bioassay is required. The drug is prescribed by weight, not by units; hence, greater precision in dosage
3. Since glycosides vary in their completeness of absorption, latent period and duration of action, the right glycoside can be selected to fit particular needs
4. Smaller amount of material can be given per dose
5. Tablets are tasteless
6. Intestinal absorption is uniform for each glycoside
7. Tablets do not deteriorate

ACTION ON FAILING HEART

Heart Muscle

Increases force of systolic contraction and mechanical efficiency
Decreases diastolic size of heart

Heart Rate

Causes vagal slowing of rapid heart rate reflexly through restoration of cardiac compensation
Has no effect on cardiac pacemaker
Shows conduction time between atrium and ventricle

Electrocardiographic Effects

Q-T interval shortened
Auriculoventricular conduction time delayed
Depression of RST segments in one or more leads
Sharply inverted T waves (toxic)
Arrhythmias (toxic)

Venous Pressure

Decreased

Blood Pressure

No uniform effect

Velocity of Blood Flow

Increased

Circulating Blood Volume

Diminished

GENERAL PRACTICE *Review*

This department offers the latest, proved methods for the treatment and management of commonly encountered conditions based on the extensive experience of the physicians who prepare these summaries especially for POSTGRADUATE MEDICINE.

Examination of the Patient with Varicose Veins

H. O. McPHEETERS AND
C. V. KUSZ

Minneapolis, Minnesota

H. O. MC PHEETERS

C. V. KUSZ

THERE are three necessary steps to the successful treatment of varicose veins of the lower extremity. These steps are (1) adequate examination, (2) adequate surgical procedure and (3) adequate follow-up examination and treatment. Each step must be followed carefully with the end result in mind.

Much has been written in the past few years regarding the surgical approach to the treatment of varicose veins, but there have been very few papers which stress the importance of the examination of the patient before a certain type of surgical procedure is employed. It is our impression that failures in the successful treatment of varicose veins are not so much due to the type of procedure used as to inadequate examination before treatment is started. Only by means of an adequate examination can the surgeon know the exact type of treatment that is best suited for the individual case. It is with a plea for a more thorough examination of the individual patient that we present this paper. As will be noticed in this paper we do not advocate any one type of procedure for eradication of varicose veins, but believe that the treatment should fit the individual case. Therefore, we use (1) the stripping operation, (2) eradication by blunt and sharp dissection and (3) injection therapy. In many cases we use a combination of any or all of these types of procedure.

During the examination phase the examiner must bear in mind the following points so that treatment may be carried out adequately. He must be able to answer the following questions at the completion of the examination:

1. Is this a venous disease?
2. Which system is involved (greater saphenous system, lesser saphenous system, or deep venous system)?
3. What type of surgical procedure must be used—stripping, dissection or injection?
4. Are there any incompetent perforators

present and what is their location?

By the use of the three basic principles of physical examination, namely, inspection, palpation and percussion, the examiner can arrive at the answers.

Inspection

The patient is disrobed from the groin downward and stands in front of the examiner. The legs are inspected for the presence of obvious varicosities, edema, location of ulcers, color of the extremity, presence or absence of atrophy and hair, eczemas and dermatitis.

While inspecting the obvious varicosities the examiner can get an indication of the system involved. In many cases varicosities on the medial aspect of the legs involve the greater saphenous system, and varicosities in the posterior aspect and lateral aspect of the lower leg in many cases involve the lesser saphenous system. Further examination, however, must be used to differentiate between the two systems. This will be discussed later.

By inspection the examiner can also get a fair estimate of the type of procedure that should be used. Straight tubelike veins lend themselves very well to intraluminal stripping. Large grapelike clusters and large saccules must be dissected bluntly. Smaller superficial and tortuous veins can be adequately injected at the time of surgery. For example, a tortuous lateral femoral cutaneous vein that comes from the fossa and extends over the anterior thigh into the lateral aspect of the leg can be treated successfully by a retrograde injection of SYLNASOL® following an adequate saphenofemoral ligation.

The presence of edema may help differentiate a patient with simple varicose veins from a patient who has a postphlebitic syndrome. Edema of uncomplicated and simple varicosities usually is not great; it usually is confined to the lower third of the leg and is present only toward the end of the day. This is in contradistinction to the edema following a deep venous system breakdown. In the postphlebitic leg the edema is greater, usually extending from the knee downward, and may even involve the thigh; this edema is present after the patient is up and about for only a few hours.

The location of ulcers can indicate whether one is dealing with a venous or an arterial disease. Ulcers of venous diseases are usually located either above or below the malleoli, while ulcers on the dorsum of the foot, toes, heels and, many times, over the anterior tibial region may be ulcers of an arterial deficiency disease. It is very important that these arterial deficiency ulcers be distinguished from varicose ulcers because in an extremity with an already poor blood supply, acute gangrene may follow a procedure to eradicate the varicosities present. Varicose veins and arterial deficiency diseases can exist in the same extremity; the varicosities in this type of extremity are usually atrophic in origin. Before a surgical procedure is undertaken to rid the patient of the varicosities, the arterial supply should be improved sufficiently so that a safe surgical procedure can be employed.

Cyanosis of the foot indicates a slowing of the circulation. This may be due to a venous congestion or to an arterial deficiency disease. Cyanosis of venous origin is usually present in an extremity which is edematous, and the congestion of the veins usually is obvious. The cyanosis which is due to an arterial disease usually is found in a foot that is not swollen, and the veins themselves even may be collapsed. However, in the presence of concomitant arterial and venous disease the veins may be engorged as they are in a purely venous disease. Temperature of the extremity, pulsation of the arteries and dependency rubor will distinguish the cyanosis of arterial origin from that of venous origin. Atrophy and loss of hair on the dorsum of the foot and lower leg are usually indications that an arterial obliterative disease is present.

Palpation

The temperature of an extremity is an important indication of the arterial supply to that extremity. A cool and wet extremity may indicate a deficient arterial supply. Extremities with simple varicosities usually are normal in temperature and at times may be even warmer than normal. Comparison of the tem-

perature of both extremities is important especially in the individual with varicosities and an arterial deficiency disease.

Palpation of the pulsations of the arteries is important. The dorsalis pedis and posttibial arteries should be palpable in extremities in which varicose vein surgery is contemplated. If they are absent, procedures to increase the arterial supply to the extremity must be undertaken before varicose vein surgery is instituted.

The examiner then should palpate the varicosed veins. In this way the system involved may be followed to its origin—the greater saphenous vein from the lower leg directly to the groin, and the lesser saphenous as it enters into the popliteal space. This will help the examiner in determining the system involved. Palpation of the varicosities also is used to determine the type of vein one is dealing with, i.e., straight tubelike veins lend themselves to stripping; large saccular veins need dissection and complete extirpation, and small superficial tortuous veins can easily be eradicated by the injection of a sclerosing material.

It is with palpation that the examiner first locates the position of incompetent perforator veins. There are a great number of communicating veins between the deep and superficial veins of the leg. These perforate the fascia but do not leave an actual defect in the fascial wall and they cannot be found by any means of physical examination. As the communicating vein becomes incompetent it dilates and as dilatation takes place a defect is formed in the fascia, similar to that in which a ventral hernia is found. This can be palpated with the examining finger in the same manner as the ventral hernia is palpated. The most common site is in the lower third of the leg about 1 inch posterior to the course of the main saphenous vein itself. The second most common site is a few inches below the knee. However, the examiner must bear in mind that the incompetent perforators can be found anywhere in the leg and especially along the middle border of the tibia. Occasionally, large sacculated varices will erode through the fascia and will feel to the palpating finger the same as the defect formed by an incompetent perforator. The Trendelenburg test is used to distinguish between this type of defect and that formed by an incompetent perforating vein. This test will be discussed later.

Percussion

During the stripping operation, especially, it is very important that the course of the veins be known at all times. In many cases—particularly in the obese patient—it is not possible to follow the course of the vein accurately by palpation alone. This is true especially in the thigh. It is in this type of case that the percussion pulse transmission test is used. By tapping on the vein at the knee the impulse thus produced is transmitted along the course of the vein through the thigh and up to the saphenofemoral junction. This makes it possible to chart the course of the vein in the thigh. Often it is not possible to palpate the vein at the knee. A percussion pulse produced in the lower leg over a prominent vein many times will be transmitted up to the knee and in many cases even to the saphenofemoral junction. Once the vein is located at the knee, the test can be continued so that the course of the vein in the thigh can be followed. The test is also used in locating the lesser saphenous vein in the calf and in the popliteal space. Percussion is made in the case of the lesser saphenous vein on the vein just lateral to the Achilles tendon. The pulse transmission can be felt in the calf and into the popliteal space.

In the adequate treatment of varicose veins one of the most important preoperative diagnostic steps is to determine if one is dealing with varicosities of the greater or the lesser saphenous system. Needless to say varicosities involving the great saphenous system cannot be treated by an attack on the lesser saphenous or vice versa. Varicosities on the medial aspect of the leg are not always varicosities of the great saphenous system and conversely varicosities on the lateral aspect of the leg are not always varicosities of the lesser saphenous system. The percussion pulse transmission test will give to the examiner the diagnosis of which system is involved. It is

perfectly obvious that a percussion pulse initiated in one part of a tube will travel upward into another part of the tube only if they are connected. Therefore, an impulse originating in the varicosities on the lateral or posterior aspect of the leg that is transmitted to the medial aspect of the thigh or even into the saphenofemoral junction and not to the popliteal space will mean that the lesser saphenous is not involved and that these varicosities, even though they are in the area drained by the lesser saphenous system, really involve the greater saphenous vein. The surgical attack must be directed at the saphenofemoral junction and the greater saphenous system.

The most common error we have seen is an attack on the greater saphenous vein for varicosities on the medial aspect of the leg in which the lesser saphenous has been the offending vein. A percussion pulse transmission test done properly would have directed the examiner to the popliteal space and the lesser saphenous system. We have seen cases in which a varicose vein was present at the medial aspect of the knee but the percussion pulse transmission test gave no impulse to the saphenofemoral junction, but did give a positive test into the popliteal space and the lesser saphenous vein (these veins were successfully treated by a surgical procedure which attacked the lesser saphenous system). Further proof of this can be had by the use of the Trendelenburg test.

The Trendelenburg Test

The Trendelenburg test is important in three ways: (1) It is proof that the dilated veins are varicosed, diseased veins and need treatment. (2) It locates together with the palpation test the site of incompetent perforator veins. (3) It will give positive proof together with the percussion pulse transmission test as to which system is involved.

The Trendelenburg test is done in the following manner: The course of the vein is marked with the patient standing, in order that the varicosities may be filled. This is essential so that the examiner can know the exact areas to palpate during the test. The patient then lies down on the examining table and the leg is elevated so as to drain the varicosities completely. A tourniquet is then applied, usually in the first instance about 4 inches above the knee; the patient then quickly stands and the examiner palpates the previously marked areas. He then determines the status of the vein while the tourniquet is in place. He must determine whether the veins remain empty, fill slightly or fill rapidly. The tourniquet is then removed and again the palpating finger is used to determine the change that has taken place in the vein. In a truly varicosed vein without incompetent perforator veins in the lower leg the veins will remain empty while the tourniquet is in place but will fill rapidly from above downward once the tourniquet is released. This by definition is a varicose vein, i.e., a vein in which dilatation has taken place to the extent that the valves are no longer competent and blood will flow downward as the patient stands, thereby forming a vein which no longer can carry out its normal function.

The site of incompetent perforators can be found by use of this test or one of its many modifications. We usually employ the one tourniquet test which we believe is simple and adequate. It is used in the following manner: The tourniquet is placed in the first position above the knee and the patient stands up quickly. The veins in the lower leg are palpated. If there is rapid filling even though the tourniquet is secure, it indicates either that the lesser saphenous system is involved or that there are incompetent perforating veins below the tourniquet.

The test is then repeated with the tourniquet just below the knee. The veins are again palpated and if they remain empty the possibility of the lesser saphenous being involved must be considered. If the veins again fill rapidly then an incompetent perforator vein is present below the tourniquet. The test is repeated, placing the tourniquet at various levels until the site is found at which the veins below the tourniquet remain empty while the tourniquet is secured and fill rapidly once the tourniquet is removed. The test is then repeated moving the tourniquet upward at each test until the area is found at which

the veins will fill while the tourniquet is secure. Just below this area is the site of the incompetent perforator. In most cases this site will correspond to that already found by palpation. This site must be kept in mind at all times during the operation.

If it has been determined that the lesser saphenous may be involved the test is again repeated but in the following manner: The lesser saphenous vein is found in the popliteal space by percussion and palpation, and the finger is placed on the vein for pressure. The same test is now carried out except that the finger above compresses the lesser saphenous. The palpation of the veins of the lower leg will then show that while the lesser saphenous remains compressed at the popliteal space the veins will remain empty but will fill rapidly once the compression is released.

If the examination has been carried out in the manner described intelligent and logical therapy can be instituted.

Summary

By ordinary means of physical examination the system involved can be determined by inspection, palpation, percussion and the Trendelenburg test. The type of procedure necessary can be determined by inspection and palpation and by use of the Trendelenburg test. The surgical procedure varies with the individual case and the type of veins found in that case. Thick-walled, straight veins can easily be stripped. Large saccular veins must be dissected and superficial tortuous thin-walled veins can be injected. No matter which type of therapy is chosen for the eradication of the distal varicosities each must be preceded by adequate ligation. The ligation must be flush with the common femoral vein in the case of the great saphenous varicosities and flush with the popliteal vein in the varicosities of the lesser saphenous system. The surgical procedure and follow-up care will be covered in a subsequent paper.

The Care of Old Rheumatic Cardiac Conditions in Later Life

N. C. GILBERT

Chicago, Illinois

N. C. GILBERT

THE most important part of what is done in regard to the care of older patients showing evidence of rheumatic carditis depends on the care received during and after the initial infection and during the intervening years. A great many patients who have had an early rheumatic fever have reached the later decades of life without any medical attention subsequent to the initial attack. However, we can be sure that many more rheumatic fever patients will survive to a healthy old age if they receive a moderate amount of observation and advice during the years between the acute episode and the later life which they hope to reach. Furthermore, they will reach these later years with much less cardiac damage and with a better functional capacity.

The possibility of making neurasthenics of such patients, or of making them "heart-conscious," should not be of much concern. They need not become neurasthenics if their cases are handled carefully and if thought is given to just what is said and how it is said. For that matter, I would prefer remaining on

earth as a mild neurasthenic to being a well adjusted angel!

There are two main conditions which might contribute to further cardiac damage after the initial infection and its apparent arrest. The first condition is a recurrent rheumatic infection or other nonrheumatic infections. The second omnipresent factor—and relatively more important one—is that of circulatory deficiencies of the heart muscle itself, consequent to the coronary damage which is very frequently indeed a part of the rheumatic fever involvement. The compensatory hypertrophy of the heart muscle made necessary by any valvular deficiencies resulting from rheumatic fever makes this an especially important consideration. Increased vascularity of the myocardium does not accompany the hypertrophy in proportion to the increased bulk of muscle.

Recurrences of rheumatic fever become less frequent in the latter part of the second decade of life and later. But, while the curve of incidence almost reaches a base line, it does not quite do so. Cardiac damage as a result of the later recurrences also appears to be less frequent, at least as far as obvious physical signs are concerned. Rheumatic fever is a chronic disease and we are never sure of its final subsidence; and we are not sure how many of the mild or not so mild infections in later life are not atypical rheumatic fever. It is difficult for me to visualize further valvular damage when it does occur except as the result of further infection. We cannot be sure how much we have missed or misinterpreted or how frequently these nonspecific infections predispose to further damage.

Subacute bacterial endocarditis superimposed on an old rheumatic lesion is apparently less frequent than formerly. Its decreased frequency may be due to the antibiotics, or there may be at present one of those lulls which we experienced before the use of the antibiotics. The disease certainly does not carry the same menace it formerly did, but it still does occur and may flare up after many infections in the most varied organs of the body. If all infections were adequately cared for and sufficient time given to complete convalescence, it would help to guard against further cardiac damage from any source. Neither chronic dental caries and sepsis nor the possibility of bacteremia after dental extractions should be overlooked. The latter can be readily guarded against by antibiotics given before, during and after extractions. No advice that can contribute to robust general good health should be overlooked. Included in this advice are the avoidance of fatigue and exposure, the necessity for prompt care after exposure, and the avoidance of contact with others who have infections.

The importance of an adequate blood supply to every organ of the body is necessary not only for the function of the organ but also for its future anatomic integrity. Except for some very infrequent and notable instances, the heart muscle is not directly damaged by infectious processes. When damage does occur, it is usually the result of an insufficient blood supply to the organ. The importance of circulatory deficiencies producing degenerative changes in the myocardium is so obvious that one would hardly think it would need any emphasis. The changes in the coronary arteries may be due to infectious processes involving the vessel walls and narrowing them as in rheumatic fever, or they may be due to metabolic processes of which we know little or nothing.

Rheumatic fever has long been recognized as a disease producing widespread arterial damage. It frequently involves the coronary arteries of the heart—perhaps only one, two or even all the branches. The review by Wartman[1] summarizes all the essential material and references. Karsner and Bayless[2] made a very thorough pathologic study of the effects of rheumatic fever on the coronary arteries of the heart at various ages during advancing decades. They stated:

> The acute lesions of the coronary arteries go hand in hand with acute lesions of the myocardium. The latter are destructive and lead to scarring. The amount of scarring increases with age . . . Extensive myocardial fibrosis can better be explained by chronic arterial disease than any other source . . . Rheumatic fever predisposes to fibrosis of the coronary tree and to what appears to be precocious coronary sclerosis . . . It is practically certain that severe myocardial damage is associated with the arterial disease. The resulting

effect upon myocardial efficiency appears to be of significance in the clinical management and prognosis of rheumatic heart disease.

Quite aside from what can be done to modify or arrest the cause of the rheumatic infection in the acute episode, full attention should be given to the possibility of a decreased blood supply to the myocardium. However little we may be able to do to modify the changes in the arterial walls, we may be able to do something to increase the blood supply through the vessels as they are—by the use of coronary vasodilator drugs as advocated by McCullough and others. It is fortunate that the salicylates so generally used in rheumatic fever have a mild vasodilator effect upon the coronaries.[3]

We must avoid the use of drugs which have a tendency to decrease the coronary flow, as does digitalis when used in more than the optimum dosage and when not directly indicated. It is difficult to get away from the conceptions of previous generations in regard to the use of digitalis; this drug has been used traditionally wherever the word "heart" is mentioned. It is one of the most valuable and active of therapeutic agents, but there are definite indications for its use, and the mere presence of a heart lesion is not one of them. It may induce auricular fibrillation by its vagal effect in a normal mechanism.[4]

Clinically, without any experimental evidence, it is clear that degenerative changes in the heart muscle must occur when the heart muscle does not receive a blood supply adequate for its needs. When the blood supply was diminished by a vasoconstrictive agent, such changes occurred in the experimental animal, as shown by the Banting Institute group.[5-7] Such changes were also shown by Kyser and others,[8] when blood supply to the muscle was decreased by digitalis overdosage with its consequent vasoconstrictor effect. In Kyser's experiment the changes did not occur to the same degree when a vasodilator drug was used concurrently. Nalefski[9] has shown similar degenerative changes in the heart muscle with small doses of ergotamine when its use was continued for six weeks. Blumgart and his associates[10] showed the immediate effects when the coronary flow in one branch was interrupted for short periods, and showed irreversible effects if the flow was interrupted for 15 to 20 minutes.

As a sequel to rheumatic fever, there are valvular lesions which result in varying degrees of hypertrophy. In such conditions the coronary flow is at a disadvantage, for it must supply a greater bulk of heart muscle with the same number and the same distribution of blood vessels which were present before the hypertrophy took place. The importance of this is well brought out by Roberts.[11] Just what part increased anastomoses, increased caliber of the vessels and increased collateral circulation may play in relieving this situation, we do not altogether know. Clinically it is apparently insignificant and inadequate if present. On the other hand, such increases in collateral circulation might explain why so many patients reach old age despite extensive valvular damage from earlier rheumatic lesions. In such patients the coronaries may have received a minimal amount of damage. We do not know the part played by the increased load which exercise forces upon the coronaries, thereby increasing the anastomoses and collateral circulation.

If the lesion is an aortic insufficiency the coronary flow is at an additional disadvantage for the flow is a direct function of the mean blood pressure, and if the systolic pressure falls below a critical level which cannot compensate for the decreased diastolic pressure, the volume of flow is decreased and may be inadequate. Nothing should be done to lower the compensatory high systolic pressure, and since the rapid pulse rate helps maintain this pressure at a high level, it should be left alone. In aortic stenosis the problem is frequently even more difficult, because the stenosis does not permit an increase in systolic pressure to compensate for the aortic insufficiency which may be present.

We have every reason to assume that repeated episodes of reflex vasomotor narrowing of the coronary arteries will eventually produce some myocardial damage in patients, just as such episodes cause degenerative changes in the experimental animal. In those

who have had rheumatic fever there is in many or even most patients already some inadequacy of the coronary flow, and anything which might possibly increase the inadequacy should be avoided. Reflex coronary vasoconstriction may arise from many sources, such as gallbladder, diverticula of the stomach or duodenum, hiatus hernia, duodenal ulcer, pleura, breathing cold air through the nose or facing a cold wind. Such reflexes decreasing the coronary flow have all been reproduced in the experimental animal. The possibility of such reflex phenomena should be considered and appropriately cared for.

Care also should be taken not to throw too great a load on a possibly undernourished heart muscle by any exertion. The continuation of such overloads will cause permanent damage.

Coronary Vasodilator Drugs

I have spoken of these drugs so much that I would feel more diffident about saying anything further were it not for their great importance.

In a disease process where the coronary arteries are even slightly involved, it would seem the rational and common sense thing to do to get more blood through the arteries just as they are, since we cannot restore youth to the damaged arterial walls. This applies not only to the elderly patient with an old rheumatic carditis but also to all patients in whom there is hypertrophied heart muscle from any cause or any evidence of coronary insufficiency. I am sure that in patients whom I see, life not only is prolonged but also is made more livable and exercise tolerance is increased. As Dr. Fahr has said, "It cannot be more than an impression," but in his cases, as well as my own, the impression is based on years of observation. It is obvious that one cannot rely on parallel, identical control cases or on a few days of hospital observation. It can only be the impression of long years of clinical observation of the same patients.

I will not enter into any discussion of specific vasodilator drugs but will only say that there are many such agents, even if they do not receive the attention which they obviously deserve. In spite of direct and abundant experimental and clinical evidence, their value is not recognized as fully as it should be, nor are they used as much as they should be. Their value could not be doubted by anyone who has seen a left heart failure relieved in a matter of minutes, the pain of a coronary thrombosis disappear without the use of narcotics, or angina of effort relieved over a period of years. These agents are not "cure-alls," nor can they change anatomic conditions of the heart or its valves, but they usually can be counted on to be of definite help in just one thing—improving coronary flow.

Such agents should be those which act directly upon the coronary vessel walls, and should cause no significant lowering of the systemic blood pressure. One exception to this is atropine or belladonna, or one of the other parasympathetic inhibitor drugs. The coronary arteries generally carry some vasoconstrictor tone which is relieved by the use of these agents, with a consequent vasodilator effect. Their side effects on the bowel are usually also of value, if they do not produce too much atony or adversely affect the detrusor urinae muscles of the bladder or overdilate the pupils.

The agents acting directly on the vessel wall occasionally cause some unpleasant gastric or nervous symptoms. These effects usually can be avoided by the use of preparations which are insoluble in the stomach, either because they are insoluble salts or because they are enteric-coated. Such preparations are absorbed readily from the intestine. Changing from one preparation to another may result in finding a more suitable form. In the use of khellin in various forms, experimental change in dosage may frequently result in the avoidance of unpleasant symptoms.

The xanthine preparations appear more valuable clinically, for in addition to their vasodilator effect they also influence permeability, as shown by Zak[12] and Nalefski.[13] In the use of any one agent over such long periods of time as suggested here, the question arises as to whether tolerance is acquired. This seems unlikely in drugs acting directly on the vessel walls. It has been ob-

served also that patients taking drugs such as the xanthines for angina pectoris will have a recurrence of the anginal symptoms on discontinuing the drug, and will again be relieved by resuming it.

The vasoconstrictor effects of certain drugs must always be kept in mind. Among these drugs are digitalis (with only moderate overdosage), barium chloride, ergotamine, PITRESSIN® and others. Quinidine also carries untoward possibilities. While it is valuable for its inhibitory effect upon irritability, it must be kept in mind that it inhibits every property of the heart muscle.

It is obvious that there are many cases of auricular fibrillation and of heart failure with a normal mechanism where digitalis must be used. Its use must be watched carefully and the patient taught how to use it himself without causing toxic symptoms. When a patient does not do well and the urinary volume decreases, the doctor should at least wonder whether an increase or a decrease in dosage is not advisable. When anginal pain occurs, it is practically always due to overdosage.

Do not think that I am opposed to the use of digitalis. I am only opposed to the thoughtless and indiscriminate use of this valuable drug.

I have attempted to outline a practical, common sense approach to the effects of rheumatic carditis in elderly patients. The essential thing, of course, is the care given in the years intervening between the initial episode and old age. I have emphasized the necessity of thinking just what abnormal conditions we have to combat, the effect on the myocardium of those abnormal conditions, and just what means we have to meet them.

I have not said as much as I would like about the avoidance of too much therapy. What therapy I have advised is that directed toward a definite end. Complaints should be listened to attentively and symptoms evaluated thoughtfully to determine whether treatment is needed. As Osler wrote, the medicine is often harder to get over than the disease. Introducing one variable often makes it necessary to introduce another to overcome the first. A great many patients, young and old, are receiving too much medication. We should always keep in mind Cannon's dictum about the ability of nature to return to a normal equilibrium without the doctor's proffered hand.[14,15]

REFERENCES

1. WARTMAN, W. B.: Factors concerned in narrowing or occlusion of coronary vessels. In: Blood, Heart and Circulation. Washington, D. C., The Science Press, 1940.
2. KARSNER, H. J. and BAYLESS, FRANCIS: Coronary arteritis in rheumatic fever. Am. Heart J. 9:557-585, 1934.
3. GILBERT, N. C., NALEFSKI, L. A. and FENN, G. K.: Unpublished data.
4. RESNICK, W. C.: Transient auricular fibrillation following digitalis therapy with observations upon the use of atropine. J. Clin. Investigation 1:181, 1924.
5. HALL, G. E., ETTINGER, E. H. and BANTING, F. G.: An experimental production of coronary thrombosis and myocardial failure. Canad. M.A.J. 54:9, 1936.
6. ETTINGER, E. H., HALL, G. E. and BANTING, F. G.: Effect of repeated and prolonged stimulation of the vagus nerve in the dog. Canad. M.A.J. 35:27, 1936.
7. MANNING, G. W., HALL, G. E. and BANTING, F. G.: Vagus stimulation and the production of myocardial damage. Canad. M.A.J. 37:114, 1937.
8. KYSER, F. A., GINSBERG, H. and GILBERT, N. C.: The effect of certain drugs upon the cardiotoxic lesions of digitalis in dogs. Am. Heart J. 36:451, 1946.
9. NALEFSKI, L. A.: To be published.
10. BLUMGART, H. L., HOPP, H., LANDOWNE, M. and SCHLESINGER, M. J.: Experimental studies on the effect of temporary occlusion of coronary arteries. Tr. A. Am. Physicians 52:210, 1937.
11. ROBERTS, J. T.: The role of the small vessels and nerves of the heart in heart failure, coronary artery thrombosis and cardiac pain. M. Ann. District of Columbia 11:483, 1945.
12. ZAK, E. R.: Tissue action of theophylline and other xanthines. Exper. Med. & Surg. 1:181-187, 1943.
13. NALEFSKI, L. A. and GILBERT, N. C.: The effect of aminophylline on cell membrane permeability and oxygen utilization. Central Society for Clinical Research, November 4, 1950, p. 78.
14. CANNON, W. B.: The Wisdom of the Body. New York, W. W. Norton & Company, 1932.
15. ———: Organization for Physiological Homeostasis. Washington, D. C., American Physiological Society, 1929.

AUTHOR'S CORRECTION

On page 139 of the February issue ("Thyroid Diseases" by Robert S. Dinsmore, M.D.), the name of Dr. Hertz was incorrectly given as Hirsch.

Pediatrics IN GENERAL PRACTICE

For general practitioners, who handle more than 85 per cent of all pediatric care, POSTGRADUATE MEDICINE *here presents authoritative, up-to-date summaries by specialists in pediatric problems.*

The Problem of Mental Deficiency in Children

LEO KANNER*

Johns Hopkins Hospital, Baltimore, Maryland

LEO KANNER

THE word oligophrenia, or any of the terms often used as synonyms (amentia, feeblemindedness, mental deficiency), covers a wide range of conditions which differ in degree, cause, pathology and social implications. A greater or lesser extent of intellectual inadequacy is the common denominator. Because of the considerable variety of problems involved, individuals belonging in this category present an important challenge to the task of human engineering, in which medicine, psychology, anthropology, education, social work and vocational guidance have a collaborative interest.

Only the very severe handicaps were recognized in the early days and studied in institutions to which the patients, wholly incapable of functioning extramurally, had been committed for custodial care. The older discussions were therefore confined to the extremes of defective mentation and referred in the vast majority of instances to gross cerebral anomalies. Ireland in 1877 distinguished 12 varieties of "idiocy" (genetic, microcephalic, hydrocephalic, eclamptic, epileptic, paralytic, traumatic, inflammatory, sclerotic, syphilitic, cretinous and caused by deprivation). Tredgold's grouping in 1908 did not go much farther; mongolism, porencephaly and Tay-Sachs disease were added to the list and a distinction was made between "primary amentia," based on "a numerical deficiency, irregular arrangement and imperfect development of the cortical neurones," and "secondary amentia, due to an arrested development of cortical neurones."

The field was broadened substantially in the early part of the twentieth century when Alfred Binet introduced scientifically valid methods of measuring intelligence. The concept of the intelligence quotient (test age multiplied by 100 and divided by life age), as suggested by William Stern, established a practically useful scale which made it possi-

*Director, The Children's Psychiatric Service, The Harriet Lane Home for Children, Johns Hopkins Hospital, Baltimore, Maryland.

ble to assess a person's cognitive potentialities as compared with other persons of the same age. The hundreds of thousands of tests performed in many countries with the Binet and other scales tended to dismiss the old notion that humanity was divided into two parts, one that was definitely oligophrenic and one that was just as definitely not oligophrenic. A sense of relativity was brought into being. Each individual could, as it were, be placed on one of many rungs of a ladder: If the ladder had 20 rungs, each representing 10 points of the intelligence quotient, there would be considerable crowding on the eighth to eleventh rungs and a gradual thinning toward the top and the bottom. Testing thus produced an appreciation of *degrees* of possession of that which was tested. Once an "average" was established, it was possible to determine the distance between it and any deviation in either direction. Terman used this scheme to classify persons of lower than average intelligence on the basis of their test performances:

Intelligence quotient	*Classification*
90-110	Average
80-90	Dullness
70-80	Borderline deficiency
50-70	Moron
25-50	Imbecile
Below 25	Idiot

This grouping has received universal acceptance and application; it must, of course, be considered in conjunction with many factors of etiology, clinical syndromes, and the special peculiarities of the individual patient. Even a very low test score is not always an indication of inherent oligophrenia; lack of responsiveness of a schizophrenic person, unrecognized deafness or negativistic refusal to cooperate with the tester may give the erroneous impression of a severe defect in the original intellectual endowment.

A review of the population, the literature and everyday experiences in communities, clinics and institutions confronts one with the different diagnostic categories, modes of adjustment and treatment possibilities of those who have been lumped together by the all-inclusive term oligophrenia. An appraisal of the differences compels us to differentiate between three disparate varieties: absolute, relative and apparent feeblemindedness.

Absolute Feeblemindedness

This group consists of individuals so markedly deficient in their cognitive, affective and constructively conative potentialities that they would stand out as defectives in any existing civilization. They are those designated as idiots and imbeciles. They would be equally helpless and ill-adapted in a society of savants and in a society of savages. They are deficient not only intellectually but also in every sphere of mentation. They are truly, absolutely, irreversibly oligophrenic in every sense of the word. The most carefully planned therapeutic and educational efforts will not succeed in helping them to function self-dependently without the need for protective supervision. They continue throughout their lives in need of custodial care, the custody being carried on by relatives or in appropriate institutions.

It is to be expected that such a conspicuous departure from the norm should frequently be associated with marked structural abnormalities. It is true that there are idiots whose clinical neurology and postmortem pathology show little to explain the magnitude of their developmental shortcomings; factors other than demonstrable tissue alterations must be adduced for an understanding of the nature of the defect. However, in a majority of instances evidence of cerebral or metabolic damage can be ascertained and the patient can be assigned diagnostically to a specific clinical category. Many attempts have been made to group these syndromes according to either etiology or histologic findings, but either attempt has led to considerable, and sometimes confusing, overlapping.

Some of the diseases which produce absolute feeblemindedness are extremely rare. Others are sufficiently common to deserve prompt recognition by pediatricians and general practitioners. In this discussion it seems advisable to select a few typical conditions for brief mention.

Porencephaly is characterized by lack of brain substance, mostly in the anterior and middle parts, allowing a communication be-

tween the surface of the cortex and the lateral ventricle. Few such persons survive the period of infancy.

Microcephaly is unusual smallness of the brain and skull, out of proportion to other measurements of the body. Convulsions occur in approximately one-half of the cases.

Hydrocephalus is an accumulation of an abnormal amount of cerebrospinal fluid in the ventricles or in the subarachnoid space. It is either present at birth or acquired later. The excessive quantity of fluid results in impaired development of brain substance. Most of the children who do not die at birth have serious mental defects, though there are mild cases in which there is present only slight intellectual retardation.

Phenylpyruvic acid oligophrenia was first described by Fölling in 1934. It has been ascribed to a developmental anomaly of the brain. The substance can be demonstrated by adding a few drops of a 5 per cent solution of ferric chloride to acid urine; a dark green color appears and fades away in a few minutes.

Amaurotic familial idiocy was first reported by Tay in 1881 and established as a clinical entity by Sachs in 1896. It is a familial degenerative disease. The mental defect does not appear until the fourth to tenth month of life, following which there is progressive deterioration. Death occurs before the end of the third year. The characteristic ocular changes appear as the cherry red spot in the region of the macula lutea and optic nerve atrophy. Spielmeyer and Vogt described a juvenile form which manifests itself between 4 and 16 years of age.

Dementia infantilis was made known by Heller in 1908. These children develop normally at first, regress between the third and fourth years, and become restless, irritable and mute and experience complete mental deterioration. Motor function is not impaired and an intelligent physiognomy is retained. The pathologic findings indicate a neurogenic origin of the disease.

Gargoylism, described by Hunter in 1917 and by Hurler in 1919, refers to a combination of stunted growth, distorted shape of the head, grotesque face, large liver and spleen and gross mental defect with severe behavior disturbances.

Mongolism, known by this name since 1866, is characterized by specific somatic anomalies affecting chiefly the configuration of head, eyes, tongue and limbs. Few patients reach an intellectual level above 4 years.

Cretinism, based on congenital deficiency of the secretion of the thyroid gland, endemic in certain regions and sporadic everywhere, is always associated with marked oligophrenia which, however, can be influenced favorably to some extent by administration of adequate thyroid medication.

Tuberous sclerosis, first described by Bourneville in 1880, is a syndrome consisting of a combination of multiple sclerotic areas of the cortex, sebaceous adenoma of the skin, congenital tumors of various internal organs, convulsions and progressive mental deterioration.

These are but a few of the clinical syndromes associated with socially disabling mental limitations. Intellectual growth can be kept at a minimum, arrested after some progress has been made or pushed back to earlier levels in cases of congenital syphilis or after cerebral trauma and encephalitis or meningitis in infancy. The deterioration of some epileptics can be observed in institutionalized patients. It is known that maternal rubella during the first three months of pregnancy may result in congenital cataracts, deafmutism, heart disease, diplegia and severe oligophrenia. The children who survive erythroblastosis fetalis and kernicterus rarely develop mentally beyond the level of absolute feeblemindedness.

Relative Feeblemindedness or Intellectual Inadequacy

A large variety is made up of individuals whose shortcomings are definitely related to the standards of the particular society which surrounds them. In less complex, less intellectually centered societies, they would have no trouble in attaining and retaining equality of realizable ambitions. Some might even be capable of gaining superiority by virtue of assets other than those measured by intelligence tests. They could make successful peas-

ants, hunters, fishermen or tribal dancers. They can, in our own society, achieve proficiency as farm hands, factory workers, miners, waitresses or charwomen. But in our midst, their limitations, which would remain unrecognized and therefore nonexistent in the awareness of a more primitive communal body, appear as soon as scholastic curriculums demand competition in spelling, history, geography, long division and other preparations which certainly are not essential for the task of feeding chickens or wrapping bundles in a department store.

In this group one does not encounter the major somatic pathology found among a large proportion of the absolutely feebleminded. The higher the intelligence quotient, the smaller becomes the percentage of morbid cerebral and metabolic involvements. Among members of this group, to be sure, are some hydrocephalic, epileptic, congenitally syphilitic, or postencephalitic persons not so radically damaged as to become candidates for custodial care. Among them, especially on the 50 to 70 I.Q. levels, are the persons comprised by Benda under the name *oligoencephaly*, "a genetic pathologic entity of constitutional inadequacy," based on a familial defect in the germ plasm and showing a variety of developmental deviations of the structure of the brain and spinal cord. Among them are individuals presenting the features of *hypertelorism*, described by Greig in 1924, often found in several members of the same family and consisting of an abnormal distance between the orbits, broadening of the nose bridge and anomalies in the medial part of the anterior cranial cavity. But on the whole, the large majority of the relatively feebleminded are "biologically normal" people whose intellectual inadequacy is usually the only minus quality ascertainable.

The members of this group are not absolutely deficient. Their principal handicap is a greater or lesser degree of inability to comply with the *intellectual* requirements of their society. In other respects they may be as mature or immature, stable or unstable, secure or insecure, placid or moody, aggressive or submissive as any other member of the human species. Their deficiency is an *ethnologically determined phenomenon* relative to the local standards and, even within those standards, relative to educational postulates, vocational ambitions and family expectations.

Lewis in 1933 referred to this group as "subcultural." He made an analogy between intellectual functioning and longitudinal growth. One category, the absolutely feebleminded, would correspond to the achondroplastic or rachitic dwarfs who could not possibly be regarded as mere variants from the norm. The relatively feebleminded represent the lower part of the normal frequency distribution curve of intelligence; they would correspond to those people in the community who deviate from the norm sufficiently in their height measurements to be conspicuous through their smallness yet are "normal" in the sense that the short size has no basis in organ pathology.

Unlike the absolutely feebleminded, members of this group are educable and can be helped to find a useful place in society. Many civilized countries have introduced methods of special education and vocational preparation to fit them for occupations in which they can perform necessary tasks comfortably and even skilfully. If they are forced to compete in the regular schools with students of normal intelligence, their inevitable failure often leads to frustration and compensatory behavior problems. Statistics report a greater frequency of juvenile delinquency among morons and borderliners than among children and adolescents of average or better than average endowment. This fact has mistakenly been blamed on the intelligence quotient as such. However, experience shows that the incidence of antisocial activities among properly guided and trained "defectives" is far lower than among those for whom their communities have failed to provide adequate facilities for adjustment.

Apparent Feeblemindedness or Pseudo-Feeblemindedness

In this variety we are confronted with individuals who appear to be limited at the time of the psychometric rating but who, under

different circumstances after effective removal of the cause, attain much higher intelligence quotients—average or better. For the time being, existing potentialities for the acquisition or reproduction of tested information have not been fully realized because of lack of opportunity, physical handicaps interfering with otherwise possible performance, remediable but not as yet remedied specific learning disabilities, or emotional preoccupations and blocking. It is easily understood that the active refusal of a negativistic child or the detached irresponsiveness of a withdrawn child is apt to yield a far lower score than is representative of the patient's actual endowment. Several conditions are especially capable of masking a child's intellectual potentialities wholly or in part:

1. Disorders of vision or hearing which reduce the ease of academic learning and the success on the ordinary scales for measuring intelligence.
2. Neuro-orthopedic damage, occurring at birth or acquired later in life, which influences motor skills and speech development.
3. Severe early illness which delays but does not prevent the manifestation of adequate intellectual development.
4. Frequent petit mal attacks or subclinical dysrhythmic phenomena which disrupt concentration and thus lower the test score considerably.
5. Protracted use of sedatives which have a dulling effect.
6. Emotional states of acute anxiety, distractibility, obsessive preoccupations or schizophrenic withdrawal.
7. Special disabilities, such as dyslexia, which may be confused with poor general ability.

While absolute feeblemindedness requires custodial care and relative feeblemindedness calls for guidance and occupational adjustment, the pseudo-feebleminded in any of the abovementioned subdivisions need expert recognition and appropriate treatment of the underlying problem.

The suggested grouping (absolute, relative and apparent feeblemindedness) does not primarily look backward to origin or cause as do the distinctions between congenital and acquired or between primary and secondary feeblemindedness. It rather looks forward to practical communal, educational and clinical possibilities for human engineering. This grouping—as any other over-all division—starts out with categories. Not only are there different subdivisions within each category, but also, as one goes on with the sorting consistently, he ultimately arrives at a point where all interest is centered on an indivisible unit, the patient. The rapid advance of individualized psychology and medicine in the past few decades has taught us that the surest road to the patient leads not through the broad highway of diagnostic classification but through the narrow trail of individual personality study. A relatively simple scheme, the *personal profile,* can be used in all three varieties. This profile, characteristic of the patient at the time when he is brought to our attention, not only takes care of allocation to a subgroup but also tells all that we must know about the patient in order to understand him and his particular problems and needs and to proceed with appropriate measures for manipulation, guidance or therapy. In every instance it seems best to orient oneself about six sets of determinants:

1. Genetic determinants.
2. Cultural determinants.
3. Material determinants.
4. Physical determinants.
5. Educational determinants.
6. Emotional determinants.

Genetic Determinants

The distinction between absolute and relative feeblemindedness suggests, as an important corollary, the advisability of a separate consideration of heredity with regard to both progeny and offspring. There are marked differences even in the transmission of absolute feeblemindedness. While there is a decided hereditary tendency in Tay-Sachs disease, Heller's disease appears without any ancestral premonitions. Idiots and low grade imbeciles hardly ever reproduce, especially in a commonwealth in which they are segregated and supervised safely from an early age.

According to the latest statistics, approximately 30 per cent of the feebleminded (both absolute and relative) have inherited their intellectual shortcomings.

Lewis' concept of the intellectually inadequate as "subcultural" variants rather than pathologic specimens and his analogy to variations in longitudinal growth deserve far more recognition than they seem to have received. One does not deplore the existence of taller-than-average or smaller-than-average people just because of their size. A tall person, it is true, may require certain "adjustments": a suit made to order, a larger bed, more space in which to stretch his legs between his chair and the table. He is "normal" so long as he lives and behaves normally. If he is psychotic or a criminal, he requires the same study and treatment as does any average-sized psychotic or criminal person. The same consideration holds true for the intellectually inadequate.

The genetics of feeblemindedness might therefore be best split off into two avenues of inquiry:

1. The genetics of absolute, eminently pathologic feeblemindedness.
2. The genetics of variants, of relative feeblemindedness, with due reference to social and emotional implications.

The situation is complicated further by the undoubted inclusion of many unrecognized pseudo-feebleminded in heredity statistics.

Cultural Determinants

The absolutely feebleminded represent an irrevocable loss in this or any other culture. With few exceptions they are "institutional material."

The intellectually inadequate are the victims of a firmly intrenched group attitude. Ability, in a culture centered predominantly on cognitive performance, means capacity for competition in the intellectual sphere. Our educational system, our vocational hierarchy and our economic scheme are built primarily on the requirement of conceptual cleverness. A reasonably high I.Q. is the admission ticket to anything that is viewed as "success" in our society.

It is often forgotten that the stable, secure, well adjusted among the intellectually inadequate, far from being liabilities, are great and indispensable assets to our society as it is constituted. They will never, to be sure, create anything like Faust, the Symphonie Pathetique, the Sistine Madonna, or even feeble, ephemeral literary pieces, musical compositions or objects of art. They will never sit in the councils of the wise. They will never contribute to the progress of science. But sewage disposal, ditch digging, potato peeling, scrubbing of floors and other such occupations are as necessary and essential to our way of living as science, literature and art. Garbage collection is an essential part of our public hygiene measures. For all practical purposes the garbage collector is as much of a public hygienist as is the laboratory bacteriologist. All such performances, sometimes referred to superciliously as "the dirty work," are indeed real and indispensable contributions to our culture, without which our culture would collapse within less than a month.

The fortunate fact that people, regardless of I.Q., are available for these performances frees the time and energies of others for tasks which involve planning and creative activities. This is what makes psychometric and aptitude tests so valuable. The tests make it possible to assign people to the particular, neither superior nor inferior, but intelligently gauged types of education and vocation for which they are suited. A well organized society will try to allocate its variegated functions in accordance with the best specific use it can make of its individual members. The more nearly the intellectually inadequate can be prepared for, and assigned to, jobs for which they are fitted, the more occasion is there for the intellectually more adequate to make corresponding use of their cognitive assets.

Some people are in the habit of dismissing the intellectually inadequate as a bunch of misfits. Many of them, it is true, *are* misfits. But this they are not because of the I.Q., but because society has failed to help them to fit themselves to usefulness. They are misfits in schools which expect of them achievements of which they are not capable. They are misfits

in life because we, the intelligent planners, have not fitted them for the things which they can do with profit to themselves and their communities.

Material Determinants

The significance of the material environment (economic conditions of the family, housing situation, neighborhood) is too well known to need special emphasis. The slums are assuredly greater breeders of illness than rural or residential urban sections. There is a greater incidence of tuberculosis among the inhabitants of crowded quarters, whether they be feebleminded, average or above average in intelligence. A combination of extreme poverty and ignorance about elementary nutritional requirements results in a greater incidence of rickets and scurvy. A general improvement of hygienic standards in homes and institutions has lengthened the average life span of mongolians by several years in the past two or three decades.

There is another aspect to the material situation. Every country has the type of institutions which it deserves. This applies to psychiatric hospitals and correctional schools as well as to institutions for the feebleminded. Some are excellent, modern, hygienic, humane, constructive. There are others to which one would not like to send a dog. Most superintendents and their staffs are eager to do good jobs but are often prevented from following their inclinations by meager appropriations and political interference. There is no money available for adequate sanitation, trained personnel, education, vocational preparation, research, and sometimes even satisfactory nutrition. There are places for the care of the feebleminded which are second to none of the finest and highest-priced private places. There are some which could have been hardly worse in the Middle Ages. And many stand anywhere between these two extremes.

Physical Determinants

Practically all mongolians, all untreated cretins, microcephalics, infantile dements (Heller), the majority of tuberous sclerotics and those afflicted with Schilder's disease, some postencephalitics and congenital luetics, some seriously lead-poisoned children will be found among the absolutely feebleminded. But this same group also comprises many individuals who show no neurologic, ventriculographic, electroencephalographic or postmortem signs of physical anomaly. Well administered and controlled thyroid medication has succeeded in transferring some cretins from the absolute to the relative variety of feeblemindedness. Early and effective treatment of lead intoxication plus prevention of further lead intake has caught many children in sufficient time to preclude marked intellectual stunting.

The higher up we follow the intellectually inadequate on the I.Q. ladder, the more we find that the physical condition of the group resembles that of the average population. We do find among them many brain-injured, postencephalitic, adiposogenital dystrophic and epileptic individuals. But the majority, especially in the upper brackets, are essentially in good physical health, that is, a health survey in any given section with fairly even conditions of sanitation, medical care, housing and nutrition will hardly find a noticeable difference between those adequate and those less adequate in intelligence. The *Anopheles* mosquito, the hookworm, the tick, and the pallid spirochete know nothing about the I.Q. of their victims.

Careful physical examination, correct interpretation of the findings and effective therapeutic and educational procedures spell the difference between lifelong helplessness and a life of usefulness for many of the pseudofeebleminded. Attention to visual and auditory interferences with learning and to neuroorthopedic problems preventing the motor externalization of intelligence through speech and action can not only help to bring hidden potentialities to light but also do something to turn the discovered potentialities into realized actualities. The previously gloomy outlook for the spastic child has all but vanished.

Educational Determinants

In 1945 Rapaport published his brilliant formulation of "a set of nine assumptions

which are not necessarily correct but have proved themselves useful in the clinical evaluation of test results." His second assumption reads as follows: "The maturation process is fostered or restricted by the wealth or poverty of stimulation in the educational environment during the earliest formative years."

Transfer of children from dull, drab, uninspiring homes to foster homes offering rich stimulation has often, though not always, raised the I.Q., sometimes as much as 20 to 25 points. These children obviously had sufficient natural endowment to allow such remarkable I.Q. increases under favorable circumstances, in the absence of which the existing potentialities were kept from coming to full bloom. It stands to reason that the complete absence of domestic, scholastic and cultural stimulation leaves a child mentally in the dark, even though he may have come into the world with a rich natural endowment.

Many children are "isolated," at least partially, through impairment of vision or hearing or through motor handicaps. They are thereby deprived of certain types of stimulation. Education must, and can, make up for the deficit. Children with specific reading difficulties (dyslexia, strephosymbolia) are excluded from a source of information and orientation which is indispensable in our culture. The introduction of sight conservation classes, Braille, lip reading instruction, hearing aids, methods of teaching the deaf how to talk, improvement of motor handicaps through special exercises, and remedial reading instruction have removed from many persons the appearance of feeblemindedness.

Goldfarb has called attention to another form of "isolation" which tends to reduce the I.Q. He made an extremely important study of two groups of children and adolescents. One group consisted of individuals who had been reared in orphanages during the first three years of life. The control group consisted of individuals who, coming from the same social strata, had been brought up in foster homes from the beginning. The orphanage children had the advantages of modern child care insofar as their physical needs were concerned. Diets had been calculated scientifically, ventilation and room temperature had been regulated carefully, and sources of infection had been kept away with the utmost caution. However, none of these children had an opportunity to relate himself to any one adult who could give him the necessary affection and stimulation. There was something definitely mechanical about the attention which the children received. The children of the control group did not in their foster homes have the advantages of strictly supervised sanitation but they had an opportunity to receive psychologic stimulation through fondling and play. As a result, the children of the orphanage group developed severe personality difficulties. All the psychometric and personality tests registered deficits similar to those encountered in postencephalitic and post-traumatic conditions.

"Education" means more than the technics involved in the instruction of reading, writing and arithmetic. It includes the fostering of an emotional status which would enhance the willingness to learn, the kind of stimulation which would relate learned matter to everyday living, and the consideration of individual needs. This type of education can do away with both the existence and the concept of pseudo-feeblemindedness.

The vast majority of the absolutely feebleminded and a considerable contingent of "morons" receive their education in institutions. Most of them will remain there until the end. This should by no means be an invitation to *laissez faire*. A sizeable proportion can be taught to make themselves useful citizens of the institutional community by taking part in simple occupations. In some schools the more capable residents are even hired out to neighboring farmers and allowed to keep the pay they earn for themselves or to turn it over to their families.

The vast majority of the intellectually inadequate can be adjusted and guided to suitable occupations in the localities in which they reside. In far too many places they are still not only carried in the regular school grades but also, with a singular lack of understanding, required peremptorily to follow the curriculum or suffer the consequences. Un-

fortunately, society suffers the consequences with them. For the rebuff which they experience constantly, the undeserved accusation of laziness, the harsh punishment for the misinterpreted behavioral defenses against all this, the whole campaign of hostilities leads often to aggressive resentment, to hatred of school and all that it stands for, to hatred of pushing and punitive parents sometimes urged on by the school to "do something about it," to hatred of the world in general which has offered no helping hand, cast them harshly aside, and has no place for the uneducated, vocationally unprepared, emotionally warped, rebellious, disgruntled, resourceless "defective." Out of this group comes the lamented "defective delinquent."

Progressive communities provide in their school systems opportunities for special, noncompetitive education in special classes. The stigma of grade repetition or demotion is thus removed. The pressure of contrast with children who are more gifted is taken away. Expectation is adapted to ability. Nobody becomes indignant at the thought that these pupils will grow up without having learned the Pythagorean axiom, the date of the battle of Trafalgar, and Homer's contribution to the world's literature.

Emotional Determinants

The third of Rapaport's nine assumptions reads as follows: "The maturation process is one aspect of personality and is guided, fostered, or restricted by the emotional development which takes place."

We are barely beginning to realize the extent of emotional penetration into otherwise unimpaired intellectual functioning. We are barely emerging from an era when elegantly reasoned "insight" was handed out as *the* treatment of emotionally disturbed people, when parents, teachers and juvenile court judges tried to "help" misbehaving children through logically phrased warnings about consequences.

In reviewing the emotional determinants in any individual instance of absolute, relative or apparent feeblemindedness as a part of the "personal profile," it is well to distinguish between two types of emotional impact. They cannot perhaps be always kept too strictly apart because, as the patient presents himself to us, they have been amalgamated and integrated in his personality. But even a rough analysis will bring some of the essential differences to light:

1. Emotional impacts resulting from impaired functioning.
2. Emotional impacts "fettering" and masking otherwise satisfactory endowment.

Even among the absolutely feebleminded, the manner in which they are treated at home and in institutions is by no means irrelevant. When parents bring their idiotic or imbecile offspring for the first time to the clinic, it is, with some experience, easy to infer the parental attitude from the child's behavior. The child who has been surrounded with affection and handled with fond patience is usually calm, secure, affable, composed. The child who has been rejected, coerced, beaten and pushed around is usually restless, insecure, aggressive and hostile.

However, the emotionally determined restlessness of the coerced child, a phenomenon which is not at all limited to feebleminded children, must not be confused with the motor agitation and compulsive fidgetiness of many brain-damaged children. Levin found among brain-damaged epileptics and others a frequent combination of overactivity and ravenous appetite comparable to the behavior of animals in which frontal lobe lesions had been produced. Kahn and Cohen ascribed this type of motor unrest to "a surplus of inner impulsions" which they believed to originate in disorders of the brain stem. They suggested the designation of *organic drivenness*, the main characteristics of which are a high degree of general overactivity with choreiform or tic-like movements; difficulty in maintaining quiet attitudes, even for a few seconds; abruptness and clumsiness in performances and movements, and explosive motor release of all voluntarily inhibited activity.

The emotional impact on the intellectually inadequate produced by the attitudes of parents, teachers, classmates, playmates and neighbors does not differ fundamentally from

the impact on intellectually average children exposed to similar attitudes. The main difference is, of course, that delayed development of early functions, especially speech, and inability to progress in the school grades offer added motives for parental anxieties, disappointments and disapproval. These feelings, communicated to the child, drive him either to rebellion and retaliatory behavior or to crushed and defeated resignation with a deferred externalization of accumulated hostility.

Equally pathetic is the emotional impact on many of the pseudo-feebleminded. It is easy to imagine but difficult to describe the tragedy of the blind, deaf or spastic child who is given no opportunity to make use of his existing innate abilities. One cannot deplore enough the ghastly plight of the intelligent nonreader who, undiagnosed and untreated, experiences the humiliations of grade demotions, the accusations of dumbness and laziness and the punitive campaign of enmities conducted by parents and teachers. Moses was at least allowed a glimpse of the Holy Land which he was never to enter. These children are often made miserable by the prediction of worthlessness, by the threat of institutionalization.

There are unquestionable emotional interferences not only with selective areas of learning but also with the totality of intellectual functioning. Goldfarb's studies furnish incontestable evidence of this. During the past 10 years we have become acquainted with a circumscribed syndrome, now known by the name of *early infantile autism*, which shows itself in extreme withdrawal and obsessiveness beginning as early as in the first two years of life. These patients come of intelligent and vocationally successful parents who are in good economic circumstances and of homes in which every necessary provision has been made for material comfort. Nevertheless we find almost invariably that the children have been brought up in emotional refrigerators in which there was extremely little fondling and cuddling, in which the infants had been treated more as coldly watched and preserved experiments than as human beings enveloped in the warmth of genuine parental affection. In some of these instances the severe psychopathy could still be attenuated therapeutically.

Many of the autistic children are functional idiots when they are brought for examination at 3 or 4 years of age. They do not talk, do not respond to other people, have temper tantrums when they are interfered with, have peculiar stereotyped motions and are not accessible to any kind of testing. Some remain so for the rest of their lives. Only the early history and the characteristic symptoms (withdrawal, retention of an intelligent physiognomy, better relation to objects than to people, obsessiveness) distinguish them from born idiots. For all practical purposes they function on the level of absolute feebleminded-ness. Yet some of them, with permissiveness and affectionate stimulation, are able to make sufficient compromise with reality to re-enter the world from which they had removed themselves so completely.

When Weygandt wrote his masterful monograph on idiocy and imbecility, he called attention to the "schizophrenic symptoms" which are found in some severely defective children. He observed stereotypies, neologisms, echolalia, compulsive acts, repetitious behavior and catatonic-like excitement. It is quite possible that some of these patients were autistic children who, deposited in institutions, could surrender unconditionally to their withdrawal tendencies and actually "became" idiotic, retaining some of their schizophrenic characteristics. One wonders if some persons who are harbored in institutions for the feebleminded are not in reality individuals whose early infantile autism had not been recognized and who abandoned themselves uncompromisingly to idiotic-like dysfunction. Some of the cases reported by de Sanctis as *dementia praecocissima* probably belong in this group.

Summary

The remarkable advances in medical psychology underscore the wisdom of the earnest workers in the field of "mental deficiency" who feel that their area of investigation—concept, practice and all—calls for a thorough modernization.

In the past few decades all branches of science underwent a much-needed broadening

and deepening of their scope; this was made both possible and imperative by the increasing realization that no scientific endeavor can be self limited and self sufficient. There has been a refreshing trend toward the awareness of the interrelation of the sciences which, abandoning departmental isolationism, has ceased disconnecting in theory that which interacts closely in the world of reality. The barriers between medicine, psychology, sociology, anthropology, education and jurisprudence are being lowered slowly but steadily.

The students of oligophrenia are taking cognizance of these developments. Instead of borrowing a little bit from here and from there for restricted purposes only, they see that they can draw from many related disciplines a vast amount of helpful knowledge and—this is singularly important—make their own contributions to the study of man.

Not so long ago, psychiatrists stepped out of the intramural confinement of mental hospitals where they had communion only with the extremes and end products of personal bankruptcy. As they went outside the intramural boundaries they discovered for themselves an endless range of usefulness in medicine, industry, homes, the armed services, education, everywhere.

The students of oligophrenia have, in the 'teens of this century, ventured out of the walls of institutions to view the pedagogic efforts expended on behalf of those whom the newly introduced special education could preserve for occupations and self dependence in the community. They could thus extend their interest from the ostensibly unintelligent to the less intelligent, the not-so-intelligent and the apparently unintelligent. They are ready to do something about this extension of their interest.

The first necessity in this respect is a review of the field which would include all individuals whose problems of intellectual functioning are permanently or temporarily in the foreground. It is suggested that such a purpose is served best by a consideration of the unintelligent under three separate headings: the absolutely, pathologically, irreversibly feebleminded; the relatively, culturally, trainably feebleminded, and the apparently feebleminded or pseudo-feebleminded.

This division or grouping has the advantage that it makes provision for a general program of human engineering.

The absolutely feebleminded require custodial management. Much is yet to be accomplished in this area. An improvement of the status of custodial institutions is a foremost requirement. There is a disturbing unevenness with regard to housing, health measures and personnel. While some few—very few—institutions are humanely administered, first class research centers, there are others which are little more than medieval dumping places unworthy of our civilization.

The relatively feebleminded or intellectually inadequate require adjustment and guidance. Many—far too many—communities still fail to heed these requirements. There is still much room for improvement of educational and vocational facilities everywhere.

The apparently feebleminded require above all adequate diagnosis and the treatment of those handicaps which have prevented existing potentialities from coming to full fruition.

This division is only a general, practical framework which, of course, does not dispense with the need for a thorough acquaintance with the individual patient. For this purpose, a "personal profile" is suggested which, in each instance, includes a consideration of genetic, cultural, material, physical, educational and emotional determinants.

REFERENCES

1. Benda, C. E.: The familial imbecile or oligoencephaly as a morbid entity. Am. J. Ment. Deficiency 49:32-42, 1944.
2. ———: Developmental Disorders of Mentation. New York, Grune & Stratton, 1952.
3. Goddard, H. H.: Feeblemindedness, Its Causes and Its Consequences. New York, The Macmillan Company, 1914.
4. Goldfarb, H.: Effects of psychological deprivation in infancy and subsequent stimulation. Am. J. Psychiat. 102:18-33, 1945.
5. Ireland, W. W.: On Idiocy and Imbecility. London, Churchill, 1877.
6. Kanner, Leo: Child Psychiatry. Ed. 2. Springfield, Illinois, Charles C Thomas, 1948.
7. Lewis, E. O.: Types of mental deficiency and their social significance. J. Ment. Sc. 79:298-304, 1933.
8. Penrose, L. S.: Mental Defect. New York, Farrar & Rinehart, 1934.
9. Rapaport, D.: Diagnostic Psychological Testing. Chicago, The Year Book Publishers, 1945.
10. DeSanctis, S.: Neuropsichiatria Infantile. Rome, Stock, 1925.
11. Terman, L. M.: The Measurement of Intelligence. Boston, Houghton Mifflin, 1916.
12. Tredgold, A. F.: Mental Deficiency. New York, Wood, 1908.
13. Weygandt, W.: Idiotie und Imbezillität. Aschaffenburg's Handbuch der Psychiatrie. Leipzig, Deuticke, 1915, vol. 2.

Editorials

Postgraduate Medicine

Editor-in-Chief:
CHARLES W. MAYO, M.D.

Contributing Editor:
MORRIS FISHBEIN, M.D.

Assistant Editor:
SYLVIA COVET

"A MATTER OF MONEY"

OUR readers of the aging generation may recall the old vaudeville comic who had a routine in which he courted a wealthy widow over the telephone. He would speak to her of "matrimony," but it always came out sounding like "matter of money."

Most of the nation's schools of public health are in a similar situation. They speak of the need for postgraduate "teaching," "research" and "community service," but, like the comic's words, it always comes out a "matter of money."

What place has the mundane subject of money in this professional journal? Just this: The teaching, research and community services of the 10 schools of public health are contributions to the nation and the world worthy of the highest praise and strongest support. The fact remains, however, that these schools can operate only insofar as they have the funds to operate with, and they are not getting enough funds.

A look at the privately financed schools of public health gives the clearest impression of the great need for additional support.

Earnings on Endowment

The nation's 10 schools of public health arrived late at the endowment table. By 1913, when the first school of public health was founded in the United States, those private fortunes which were to be given away already had been earmarked largely for other educational institutions and other philanthropies. Thus today only four of the schools of public health have endowment funds of a million dollars or more. (A million dollar endowment earns about $40,000 annually, or enough to meet the salaries and expenses of three top-flight professors.) This situation, serious in itself, is made all the more serious by the fact that the day of the millionaire philanthropist has all but passed. Colleges and graduate schools can no longer look to heaven and find the "miracle money" which once dropped into the laps of a few, and kept alive the hopes of many.

Tuition

Tuition income is ludicrously small compared with the cost of giving a year's postgraduate public health training to a doctor, nurse, dentist or other health specialist. The maximum tuition charged today at any school of public health is $800. The average cost of educating each of the 949 public health students in academic 1951-52 was $4100. The cost per student in each of two schools of public health was more than $6500. For an institution with decreasing *real* income from endowment earnings, the widening gap between student tuition and the cost of educating each

student is a formidable financial problem.

Foundation Grants

Unrestricted grants from foundations and trusts are extremely important but, unfortunately, few unrestricted grants are available to schools of public health. Instead, a school of public health finds that many foundations are interested primarily in "starting something." Faced with increasing costs and decreasing income, private institutions need to devote much time to consolidating and stabilizing advances already made. Such stabilization is impossible when institutions are forced to devote much of their energy to launching new projects in order to qualify for foundation support. Finally, after foundation support is obtained for some new venture, that support eventually expires and the institution finds itself with one more floor on a house that still needs a base.

Fortunately, not all foundations restrict their giving to new projects. Some of them see the need for unrestricted grants which may be used to encourage outstanding faculty members to remain at their posts. Some will contribute to the support of basic research work for which no company or governmental agency is willing to pay.

Government Grants

In academic 1949-50, 49 per cent of all money received by schools of public health for separately budgeted research came in the form of government grants; industry contributed 9 per cent, foundations 41 per cent and other sources 1 per cent. Government agencies, particularly the Public Health Service, also contributed toward the teaching and community service budgets of the schools of public health.

There is little doubt that schools of public health would happily build their budgets around gifts and grants from industry, private foundations and individuals. There is no doubt, however, that until the schools of public health are assured of support by private enterprise, they will continue to accept gratefully the kind of government support that they now enjoy.

Industrial Grants

Some industries realize that good health is good business, and they recognize the school of public health as the natural focusing point for a coordinated preventive medicine-public health attack on the health problems of workers and management. Improved health standards in this nation have meant better workers, increased production and more markets. Much of the leadership in the development of these improved health standards has come from public health specialists, trained at schools of public health. It is in keeping with industry's increased recognition of its stake in independent higher education for industry to invest in the training, research and service programs of the schools of public health.

Conclusion

Today, the greatest need of the 10 schools of public health is for unrestricted funds. They have on their faculties and among their students some of the world's best medical minds. Yet these faculty members today spend too much of their time chasing the dollars with which to carry on their important research and teaching.

Too many faculty and research workers are forced by the terms of the grants they receive to limit their investigations to finding the answer to a specific question. A question answered means only many other questions raised. The research worker should be free to follow the clues that the research itself dictates. Very few new discoveries have been made by a man looking for some predetermined answer, and the research worker who is not free to follow every mirage until he discovers it is a mirage may spend his life telling us things we already know.

Why are the schools of public health finding it so difficult to get the financial backing they need? Too few people associate preventive medicine and public health with their own personal health. In addition, too many of those persons who do know about public health and preventive medicine are not doing anything about it.

For example, mental illness afflicts this

nation with such force that our mental institutions are swamped with mental patients. There is a keen professional awareness of this problem and a high degree of public sympathy. But these reactions have been expressed largely in efforts to build and staff more mental hospitals. This is but a holding action which should be accompanied by even greater efforts to find the causes of mental illness in order to prevent and control it. If our only answer to typhoid fever, malaria, diphtheria and smallpox had been to provide more medical care, many of us today would be either dead or hospitalized.

It is true that our country is one of the healthiest on earth. But it is also a fact that a heavy toll is being taken among our people by a host of diseases and accidents, some of which are already preventable and many more of which might be brought under control if sufficient attention were given to determining their causes and to devising and applying measures to prevent them. Even in this enlightened nation, 90 per cent of every medical dollar goes toward setting right that which has gone wrong with people's health, while only 10 per cent is spent to keep healthy people healthy. Yet the total expenditure would be only temporarily higher, and in the long run would be lower, if more funds were invested now in public health training, research and service along preventive lines. Those industries, communities, states and nations which have stepped up their emphasis on preventive medicine have learned the striking truth of Dr. C.-E. A. Winslow's modern version of the old ounce-of-prevention adage. Dr. Winslow has pointed out that "the cost of sickness is greater than the price of health" and he has cited figures to show that increased investment in positive health serves speedily to reduce the amount that must be spent for illness and disability.

Optimum health is attainable for this nation if medical leadership and financial support are devoted to making the principles and practices of public health and preventive medicine a philosophy and a way of life for all our people.

J. S. S.

THE CLINICAL PROTECTION OF CHILD DEVELOPMENT

WELL over half the professional time of the pediatrician and one-third of the pediatric time of the general practitioner is devoted to well children. All of this has come about slowly and undramatically; nevertheless it represents a revolutionary advance in preventive medicine. Development as well as disease has come within the scope of clinical medicine.

The clinical protection of the infant begins with the regulation of nutrition and the supervision of his physical growth. But his welfare from the moment of birth goes well beyond purely physical needs. He grows as a unit. He is an individual, a person with characteristic ways of reacting which become more and more apparent as he matures. He displays these characteristics in a wealth of metabolic, physiologic and behavioral signs and symptoms: in feeding, sleep, muscle tonus; in eye movements; in modes of looking and listening; in patterns of posture, prehension, manipulation; in alertness, adaptiveness, vocalizations, emotional responses, and in attitudes toward other persons.

Such signs and symptoms are present at every stage of development. To the parent they are of supreme importance, because they are inevitably interpreted as evidences of the child's growth potentials. To the physician the signs and symptoms have clinical import. They are significant indicators of the integrity and organization of the child's total action system. They invite diagnostic insight, periodic supervision and guidance measures. Behavior traits and capacities constitute the most comprehensive index of the child's assets and liabilities.

Here is a vast field for a basic type of mental health protection, both for normal and for handicapped children. First things come first, and surely the newborn infant is a genuine first. He is entitled to full coverage in health protection during his early years of growth. In fact, child health must be defined as that condition which permits and promotes optimal development. It is not assumed that the physician can take over all the responsibilities of

home, school and community, but he is the key person in any systematic preventive program of mental health conservation.

For these reasons we can look forward to a more adequate clinical science of child development which can be put to large scale service. This science is now in the making. It has its sources in numerous fields of investigation, in the biologic and social sciences, including physical and cultural anthropology. The study of embryology in its systematic and experimental ramifications is sure to throw more light on the mechanisms and control of human growth, normal and atypical.

But the history of medicine amply shows that knowledge must be formulated into diagnostic procedures before it can effectively serve the individual and society. This will entail a form of constitutional medicine directed toward periodic appraisals of developmental status throughout the early life cycle. Somatic *and* behavioral characteristics contain the clues for the clinical protection of child development.

ARNOLD GESELL

MEDICAL PROGRESS—1953

EACH year I prepare for the Britannica Book of the Year a record of what I consider to have been the most important advances in research in the previous year.

The progress against poliomyelitis is most encouraging. The single step that may lead to control is demonstration of the virus in the blood of monkeys. In five out of eight attempts with chimpanzees without any apparent disease, the virus was isolated on the fourth day after the virus was fed to the monkeys. In another experiment 12 out of 23 monkeys inoculated by feeding them the virus became paralyzed and these had the virus in the blood on the seventh day after the feeding. If there is a stage in poliomyelitis when the virus is in the blood before the paralysis begins, the opportunity to destroy the virus before it reaches the nervous system is obvious.

In addition a vaccine against all three types of polio virus had its first trials on children with gratifying results. Protective antibodies were found in increased amounts in the blood. A polio virus strain was grown in developing chick embryos. The observation that received greatest publicity was the discovery that gamma globulin in a controlled experiment involving more than 50,000 children was used with success in cutting in half the likelihood of the development of paralytic polio. And these are only a few of the most significant among all the problems in the field of poliomyelitis.

The new control over tuberculosis using isonicotinic acid hydrazid, known now as one of a dozen or more products each with a different name, is of help in cases of tuberculosis, producing loss of fever, increased appetite and a condition of euphoria. In many instances combined use of streptomycin, para-aminosalicylic acid and isonicotinic acid hydrazid has brought about even better results. Some cases, such as those of tuberculous meningitis, have also been improved beyond anyone's expectations.

Only a beginning has been made with research on hyaluronidase, and the fascinating observation has been made that by its effects as a spreading factor it can disperse keloids and interfere with the formation of kidney stones. In actual cases doctors found that existing stones did not grow larger and new stones did not form after administration of this drug. Incidentally hyaluronidase is also being used in trials on breaking up keloids and in preventing their formation.

For years celiac disease has been considered a condition which was due to inability of the child's bowels to handle fats. Bananas were hailed as a great success in treatment. New research shows that the fat is not absorbed and that a diet free from wheat and rye results in increased absorption of fat. A caloric diet is given with biscuits made from corn flour or soybean flour instead of wheat. B complex vitamins are given simultaneously to prevent deficiencies. Under such treatment improvement apparently occurs in almost every case.

Among the astounding surgical developments was the report from Great Britain of the use of a new plastic or acrylic lens to take the place of the lens of the eye after removal

because of cataract. The operation has been done in some scores of cases with reported success.

The Council on Pharmacy and Chemistry of the American Medical Association regularly lists new drugs of established merit and there were many first brought into use in 1952. Examples are primaquine for malaria: DROMERAN®, a narcotic; ERYTHROMYCIN® or ILOTYCIN®, an antibiotic; the use of cobalt 12 as a substitute for x-ray; BUTAZOLIDIN® against arthritis and gout, and a new estrogenic material called TACE®.

MORRIS FISHBEIN

VITAMIN C RESTORATION AND REINFORCEMENT

THE primates, including man and the guinea pig," say West and Todd, "are the only animal species that require a dietary source of vitamin C." Surveys of human diets show that vitamin C deficiency varies in degree from mild, scarcely recognizable cases to severe forms causing death. So much has been learned already about the necessity for vitamin C in the diet that serious vitamin C deficiency is seldom seen in the United States although it may be found elsewhere in the world. Under normal conditions about one-half to two-thirds of the vitamin C taken into the adult human body is destroyed through metabolism.

Important dietary sources of vitamin C include fruits and vegetables. At current average costs, citrus fruits are not available to the mass of people throughout the world. Such vegetables as broccoli, kale, parsley and turnips are usually not eaten raw. Infants generally need more vitamin C than they get in milk, as milk is lowered in vitamin C content by pasteurization and other processing. Potatoes, beans, peas, cabbage and tomatoes must be considered in relation to the amounts eaten.

Many persons realize that they must depend on fruit juices for their vitamin C but fail to comprehend the wide differences that exist in the amounts of vitamin C that various juices provide. The Food and Nutrition Board of the National Research Council recommends a daily intake of 75 mg. of ascorbic acid for adults, 100 to 150 mg. daily during pregnancy and lactation, and 30 to 75 mg. daily for children. Certainly a small proportion of even high income level Americans get such quantities in their diet.

Consider the wide variations in vitamin C content of some common foods:

Vitamin C Content of Some Common Foods

	MG. PER 100 GM.
Orange juice, lemon juice, strawberries	40-70
Turnip greens	100-150
Tomato juice	10-30
Potato	5-30
Apple	3-10

In terms of juice one sees such figures as:

JUICE	MG. PER 100 GM. *Minimum*	*Maximum*
Grapefruit	10	50
Orange	10	70
Pineapple	5.4	18
Apple	0.2	3.6
Grape	0.0	1.7
Tomato	2.5	32.0

The Council on Foods and Nutrition of the American Medical Association grants its seal of acceptance to canned citrus and tomato products which meet the following minimum content of natural vitamin C:

	MG. PER 100 CC.
Orange juice	40
Grapefruit juice	30
Tomato juice	17.5

Recent studies have shown that great variations exist in the natural vitamin C content of juices from fruits and vegetables grown in different parts of the country. Studies have shown also the variations in other factors. Foods differ in their qualities at different seasons and they lose or gain in content of various factors.

One of the greatest contributions to modern life is the sophistication of foods that has developed with greater knowledge of the fundamental factors concerned in nutrition. No one can begin to picture properly what preservation of food by canning, preserving and freezing has brought to the American people and indeed to all the world in the way of added health and the enjoyment of living.

The simple cooked cereals of a previous century have been improved by innumerable new processes. With the coming of our new knowledge of minerals and vitamins, many products which formerly contributed little to human nutrition have been so improved by processes of reconstitution, restoration and reinforcement as to become highly valued dietary substances.

In the early days of the Council on Foods and Nutrition when I was chairman we expressed grave doubts as to disturbing in any way such foods as bread, milk and salt. Today milk is reinforced with vitamin D, the iodine lost from the salt is restored, and bread gains by the addition of minerals and vitamins. Indeed some natural foods are reinforced with other natural foods. Witness the addition of fruits and raisins to cereals and candies. Unfortunately knowledge is not yet available nor is an understanding of regulations required sufficient to enable even well informed scientific groups to determine the optimum scope of reconstitution and reinforcement.

Granted that there is a widespread deficiency in achieving a maximum intake of vitamin C necessary for maintaining an optimum level of this vitamin or of calcium, we do not know how to utilize individual food products to avoid great economic waste. Yet Nature herself is wasteful! Recently 20 different samples of frozen orange juice were studied and were found to have an average of from 30 to 45 mg. of reduced ascorbic acid per hundred milliliters of reconstituted juice. A 4 oz. glass of any of these frozen orange juices would have provided the adult consumer with a daily intake of vitamin C in excess of the 30 mg. specified by the United States Food and Drug Administration as a minimum daily requirement. The National Research Council, however, recommends a daily allowance of 70 to 75 mg. of ascorbic acid for adults. Who is to know how the remaining 45 mg. required is best to be secured? The availability of frozen orange juice means that far more people are going to have orange juice than previously. The Council on Foods and Nutrition requires that frozen orange juice contain 40 mg. of vitamin C per hundred milliliters (about 3⅓ oz. of juice) at the time of packing and that this be natural orange juice. The Council does not accept products in which additional pure ascorbic acid has been added.

Apparently far more attention needs to be given to the question of restoration and reinforcement of food products from the point of view of the effects on the product itself, on nutrition, and on the cost of utilization. The eminent physiologist Richet said that the human being is "homo stultissmus" or "idiot man" because having scientific knowledge he does not utilize that knowledge to the utmost for his own benefit. Truly we are not yet utilizing our improved knowledge of nutrition to the utmost. At least the question is debatable and much more consideration should be given to what can be accomplished by applying this knowledge to improved nutrition.

The modern scientific news contains reports of improvement of the naturally growing fruit and vegetable and animal products by modifications of the soil in which the plants are grown and of the diets of the animals whose bodies are utilized as food. Why must the process necessarily begin with the diet of the animal or of the plant rather than be included in the product just before the plant or animal becomes available on the table?

MORRIS FISHBEIN

MEN OF *Medicine*

Science and Humanism

DR. Israel Spanier Wechsler has always insisted that a good neurologist must be a good physician above all else. His own broad grasp of the field of general medicine is richly documented in his work, not only as a diagnostician for which he is justifiably famous, but also in his original contributions to scientific literature. In this age of vitamins it is not always remembered that Dr. Wechsler was in some respects a pioneer in vitamin studies. His discoveries concerning the role of vitamins in various types of peripheral neuritis are of basic importance. As a result of his work disorders previously regarded as inflammatory and attributed to a host of different causes are now known to be the result of vitamin B deficiency. This altered concept of the peripheral nerve disorders was revolutionary and stimulated fundamental research on the part of numerous workers.

The manner in which his knowledge of general medicine enriched his understanding of neurologic syndromes is well expressed in his paper on abdominal pain as a symptom of disease of the brain. He first introduced the intravenous injection of paraldehyde for the treatment of severe excitement in organic brain disease and for the control of status epilepticus. He was also the first to treat successfully petit mal seizures of an autonomic nature with ephedrine and BENZEDRINE®. His investigations of the treatment of amyotrophic lateral sclerosis with vitamin E did not fulfill its early promise as a therapy. However, his thorough studies added to the knowledge of amyotrophic lateral sclerosis and its more specific clinical classification.

More recently he has studied the problem of arteriography as a diagnostic procedure (Arteriography and carotid artery ligation in intracranial aneurysm and vascular malformation). With Drs. Gross and Cohen he investigated this topic with characteristic thoroughness, courage and imagination.

Among his most recent contributions have been an essay on the "Meaning of consciousness," another on "Neurology at the crossroads" and an original paper describing a clinical syndrome based on lesions of the hypothalamus. Altogether there are 125 titles in his bibliography, among which are three volumes—his leading "Textbook of Clinical Neurology" which is currently in its seventh edition, "The Neuroses," and a collection of provocative essays entitled "The Neurologist's Point of View."

Dr. Wechsler was born in Lespedi. Romania, on May 26, 1886, into a home in which scholarly pursuits and intellectual curiosity were encouraged. In later years he often recalled with reverence and affection the old village teacher from whom he received his first lessons. His father was a gentle, scholarly man, a great story teller, endowed with keen wit. His mother, who possessed that rare combination of great beauty, exceptional kindness and high intelligence, had enduring influence on his life. Three years before the death of his father he came to the United States as a boy of 14 to begin his studies in the public schools of New York City. His keen mind, his boundless energy and his insatiable intellectual curiosity were soon evidenced in his brilliance as a young student. In those formative years his interests ranged widely over many fields including the poetic and dramatic literature of many lands. He applied himself to the study of philosophy, history and Judaism with the thoroughness that was later to distinguish him as a scholar. As a young

ISRAEL SPANIER WECHSLER, M.D.

man he made numerous literary excursions, some of considerable merit. He developed a lucid, richly epigrammatic style which was to be widely appreciated by the readers of his scientific writings.

After receiving his medical degree in 1907 from the Medical College of New York University, he established himself in general practice. However, he found the exigencies of such practice too confining. His principal interest was in the human mind and he gravitated irresistibly into the field of neurology, hoping to find in the workings of the brain the solution to the main problems of psychiatry. His earliest publication, "The role of the emotions in the genesis of insanities and insanity from the standpoint of evolution," expressed his basic interest in psychiatry. Published in 1918, it revealed a remarkably mature understanding of human psychology. Passages in that paper make fresh reading today. As a result of his dynamic orientation he was sympathetic to the psychoanalytic point of view. The clarity of his exposition of the basic concepts of psychoanalysis in his books won him appreciative letters from Sigmund Freud and a friendship which resulted in two personal visits to Dr. Freud in Europe. His interest in psychiatry and his contributions to this field continued throughout his career, although his distinction in this regard was overshadowed by his pre-eminence in the field of clinical neurology.

Like many other eminent physicians who sought the answer to psychiatric problems by studying the workings of the brain, his work led to many findings whose primary importance was to the neurologist rather than to the psychiatrist. In 1918 he was awarded the Lucien Howe Prize for his contribution on "Ophthalmic changes in tabes and paresis." This paper revealed an encyclopedic mastery of the world literature as well as his characteristic lucidity of organization and exposition of the material. However, in addition to this capacity to amass and organize great quantities of scientific data, his was also a highly original mind. His classification, together with Dr. S. Brock, of dystonia musculorum deformans into myostatic and myokinetic forms clearly indicated the clarity of his thinking.

Dr. Wechsler has devoted countless hours of his time to the clinics and wards of New York's hospitals. He was Chief of the Vanderbilt Clinic, Department of Neurology, from 1919 until 1935. Between 1920 and 1938 he was a senior Attending Neurologist at the Montefiore Hospital, the New York Neurological Institute and the Sydenham Hospital. In 1938 he became Chief of the Department

of Neurology at the Mount Sinai Hospital and directed that service until 1951 when he was retired.

Dr. Wechsler always regarded his hospital work as a privilege and a sacred duty; in his many years of service he rarely missed a day. He was jealous even of wasted moments on the telephone. Nurses and secretaries alike were instructed not to disturb him on rounds unless the interruption was unavoidable. He did not feel that the hospital owed him anything for the work he did. He never spoke of the hours he "gave," only of the boundless spiritual riches he received on the wards and in the clinics.

In World War I Dr. Wechsler was an instructor in neurology with the Columbia University Unit and taught the medical officers stationed in the New York area. He was a member of the Columbia University faculty from 1917 to 1951, serving as professor of clinical neurology from 1927. Among the honors bestowed upon him by his neurologic colleagues were the chairmanship of the Section on Neurology and Psychiatry of the New York Academy of Medicine from 1925 to 1927, presidency of the New York Neurological Society from 1934 to 1936, and the vice presidency of the American Neurological Association from 1946 to 1947. At present he is Consulting Neurologist to the Mount Sinai, Rockland State, Montefiore and Maimonides Hospitals.

His prodigious labor in the fields of neurology and psychiatry does not by any means represent all his interests, nor do they consume all his energy. Dr. Wechsler is an enthusiastic historian and has written several significant essays dealing with the history of neurology and of psychiatry, and with Maimonides as a physician. He is a great humanitarian. In the flight from the Nazi holocaust hundreds of colleagues from foreign lands came to New York to seek his help. He was unfailingly generous in his efforts in their behalf as he is with all who seek his help.

An ardent Zionist all his life, he selected the Hebrew University in Jerusalem as a special object of his devotion. He has labored ceaselessly to further its growth by raising large sums of money, by fostering the exchange of students and faculty with American centers of learning, by assisting personally in the training of men both in this country and in Israel. He has made numerous trips to Palestine and to Israel, including a visit to Jerusalem in 1949 to take part in the inauguration of the Hebrew University-Hadassah Medical School. Recently he headed a scientific mission to the University. He is a member and deputy chairman of the Board of Governors of the Hebrew University and for several years (1947 to 1951) was the president of the American Friends of the Hebrew University in Israel.

In 1947 the Maimonides Citation was conferred on him by the Jewish Theological Seminary of America for outstanding contributions to the science of medicine and for his devoted work to the cause of the Hebrew University and the Hebrew University Medical School of Israel.

Thousands of medical students remember him as a gifted teacher. His scholarly, well organized lectures were frequently seasoned with wit and wisdom. His mastery of the epigram and the well turned phrase, his gift as a speaker and his ability as story teller often made his public addresses memorable occasions. As chairman of innumerable scientific meetings he was noted for his tact and gentle humor as well as for his rich scientific knowledge and clinical experience. Over a hundred resident physicians began their careers as neuropsychiatrists under his guidance; several of them have gone on to distinguished medical careers of their own. He not only inspired many of his young residents to continue scientific research but also frequently secured fellowships and funds to aid them in their advanced training.

Youthful in spirit, he maintains this broad front of interests. He has a large consultation practice in New York City which he leaves from time to time for trips to the Hebrew University and other schools and hospitals where he inspires young doctors with his lectures and the example of his life to love culture, humanitarianism and the search for truth in addition to their work as physicians.

SOLOMON R. KAGAN, M.D.

oral penicillin which can be given with meals

PERMAPEN

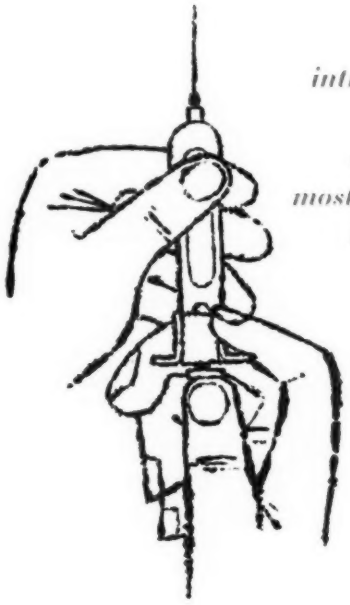
ORAL SUSPENSION

Palatable, easy-to-take peach-flavored Permapen Oral Suspension will maintain constant demonstrable blood levels of penicillin in most patients when just one teaspoonful is given every eight hours. These blood levels are independent of the relation of dosage to meals—in fact, Permapen may be given with meals without loss of efficacy.

Supplied: 2 fl. oz. bottles, 300,000 units per 5 cc. teaspoonful.

Permapen*

(BRAND OF DIBENZYLETHYLENEDIAMINE DIPENICILLIN G)



intramuscular penicillin which gives most prolonged blood levels

PERMAPEN

AQUEOUS SUSPENSION

Free-flowing, easy-to-give Permapen Aqueous Suspension can eliminate the Streptococcus carrier state in most rheumatic fever patients because just one injection will produce demonstrable blood levels in almost all patients for 14 days or longer—levels prolonged far beyond those attainable with other penicillin compounds.

Supplied: In sterile, single-dose disposable Steraject® cartridges, 600,000 units each, with foil-wrapped, sterile needle.

®TRADEMARK, CHAS. PFIZER & CO., INC.

ANTIBIOTIC DIVISION

Pfizer

CHAS. PFIZER & CO., INC.
BROOKLYN 6, N. Y.

Letters from Abroad

FROM POSTGRADUATE MEDICINE'S CORRESPONDENTS

GENEVA

Medical education today—The average age of students who intend to study medicine is 18 to 20 years when they enroll in the university after having finished their secondary schooling; the basic discipline in the secondary schools is Latin. Medical men are firmly convinced that the emphasis placed on the sciences in these schools is not what it should be. The first year in the university is devoted therefore to the basic sciences, such as botany, zoology, chemistry and physics. The examination which follows at the end of the year is a hard one, as is evidenced by the fact that 50 to 60 per cent of the students fail to pass. This process of elimination is not altogether salutary, because many students are able to survive not by virtue of native ability but because they were better prepared. No personal contacts are made between the faculty and the students during this first year in the university.

Students who have passed the examination are now ready for enrollment in the school of medicine. Here the first three semesters are taken up with practical and theoretical courses in anatomy, histology, embryology, physiology and physiologic chemistry. This crowding into two short years of all the basic science courses which form the foundation for the clinical studies which follow leaves much to be desired. The second examination, qualified as "propedeutic," is given at the end of the fifth semester. It is not as difficult as the first one, because the faculty has been working in close contact with the students.

The clinical studies commence at this level and extend over the next four years. These studies include consultation with patients, laboratory exercises and at least six months of hospital service, usually in the division of medicine or surgery. No examinations are given during these years, although ample opportunity is afforded to the students to display their aptitude in handling patients, when asked to do so before the professor and students in the amphitheater. On the other hand the duties of the faculty are so manifold that they can no longer give personal attention to each student.

Too much time is devoted to studies of specialized fields of medicine, which often is done at the expense of instruction in underlying fundamental knowledge, and therefore leads to wasted efforts. I believe that too much importance is placed on examinations in otorhinolaryngology, ophthalmology, dermatology, legal medicine, hygiene, bacteriology, psychiatry and industrial medicine. Because specialization has become an accepted fact in medicine, it obviously follows that a prospective specialist should not think of starting his practice without first grounding himself thoroughly in his chosen specialty. It thus can hardly be justified to demand of the student who wants to become a general practitioner or a surgeon that he be well informed about all the other medical specialties.

The final examination which marks the conclusion of the studies is given by the federal government. The examination lasts two months or more and comprises some 24 tests which cover all the subjects in which instruction was given, except radiology, physical therapy and occupational diseases. The examination covers both the theoretical and practical aspects of

(Continued on page A-20)

Fellows Chloral Hydrate

CAPSULES

NON-BARBITURATE
NON-CUMULATIVE
TASTELESS
ODORLESS

3¾ gr.
Daytime sedation – *without hangover*

7½ gr.
Restful sleep – *without hangover*

℞ – specify *Fellows* for the *original*, stable, hermetically sealed soft gelatin capsules Chloral Hydrate.

Available – 3¾ gr. (0.25 Gm.), bottles of 24's and 100's
7½ gr. (0.5 Gm.), bottles of 50's

Samples and literature on request

pharmaceuticals since 1866

30 Christopher Street
New York 14, N. Y.

Fellows
MEDICAL MFG. CO., INC.
Pharmaceuticals

medicine. The long duration of this ordeal, the fantastic accumulation of knowledge the candidate is supposed to possess in all fields of medicine, and the utter mental and physical exhaustion which too often results therefrom have brought this examination into ill repute. Indeed the toll taken by tuberculosis among young Swiss physicians between the ages of 26 and 30 years is as high as 16 to 21 per cent. The bad features of this examination are, however, thoroughly understood by the examiners and taken into consideration.

Students who have successfully passed the federal examination may henceforth practice medicine under the title of "physician and surgeon" anywhere within Swiss territory, after they have gone through the formality of obtaining a cantonal permit.

Usually, however, they first take up an internship to gain more experience in their chosen field of medicine. A doctor's thesis may be written, under the direction of a sponsor, while engaged as an intern. No examination is necessary for acceptance of a thesis. The title of "doctor" is automatically conferred when the medical faculty accepts for publication a piece of research work done by the candidate. The doctorate is obligatory in Switzerland only for appointment to a professorship on a university faculty and for obtaining a federal certificate to practice a medical specialty. The time of internship required to qualify as a "full-blown" specialist is at least four to five years, three or four of these being devoted to the chosen specialty and one or two additional years to related medical subjects. The diploma which marks the satisfactory completion of these requirements is issued by the federal government on recommendation of the Cantonal Medical Society and of the Federal Commission of Medical Specialists. Time spent in study abroad, no matter how long or how extensive, is never credited at more than six months.

The program of training required for general practitioners includes a long internship in internal medicine, and successive stages of service, extending over 6 to 12 months, in the sections of surgery, obstetrics, otorhinolaryngology and pediatrics. Unfortunately only a few internships are available in internal medicine in Swiss hospitals, and young doctors often are obliged to volunteer for any kind of service at a personal sacrifice. The second class and smaller district hospitals do, of course, accept graduate doctors to the limit of their capacity.

Established medical practitioners are more and more forsaking the cities and moving into the country because they find their practice is more secure and less cumbersome away from the city, where the red tape involved in handling social security patients and in obtaining hospital beds is extreme.

Internship in a hospital is a full-time job which specifically forbids engaging in private practice. The remuneration is, however, sufficiently high to permit comfortable living standards for both the intern and his family. His salary for the first year of internship is 1600 S (shilling) ($400), and reaches 2500 S ($625) in the fourth year. The head of the clinic receives about 3000 S ($750) per year.

The clinic is headed by a full professor who is assisted by several division chiefs who are completely subordinate to him. These division heads are appointed for three to four year terms (at least in the Romance language section of Switzerland), and then are superseded by young assistants who have been trained for the purpose. The drawback to this rigid setup is that it does not permit scientists with outstanding ability to become affiliated with the universities to engage in research work, and it too often obliges many specialists to start practicing too early and in the same city.

The professors and directors of the clinics do not serve "full time"; the professors usually engage in private practice as well, and often serve a considerable clientele of their own.

No examinations whatever are given during the entire duration of the internship, which is quite at variance with the practice in France and in other countries. Advancement in the medical hierarchy in Switzerland depends on the judgment of the professor and the length of time spent in the departmental divisions. The authorities who confer the diploma are seldom informed of the real value and technical competence of the candidates. On the other hand it would not be correct to conclude that every specialist in Switzerland who opens his medical shop is an expert practitioner.

The position of "associate" professor does not exist in Switzerland; it has as its equivalent a title which closely approximates it in rank and function, namely that of "privat-docent." Requisite to obtaining this rank is the execution of a piece of scientific research and passing of an open examination on subject matter which has

(Continued on page A-22)

McGRAW-HILL McGRAW-HILL MEDICAL BOOKS

Three exceptional books for student and practitioner

Hughes: PEDIATRICS IN GENERAL PRACTICE

By James G. Hughes, M.D., Professor of Pediatrics, University of Tennessee, College of Medicine, Memphis; Active Staff Member of the John Gaston Children's Hospital, and the Le Bonheur Children's Hospital.

This new book was specifically written to answer the need of busy general practitioners for a handy, concise, reference on pediatrics. The Author has condensed the fundamental aspects of modern pediatrics in a straightforward, practical manner with emphasis on the more common conditions seen in general practice. Unique in its presentation of pathologic physiology of disease states, the text stresses preventive medicine and comprehensive evaluation of the child.

735 pages, 7¼ x 9⅞, 178 illustrations $14.00

Slobody: SURVEY OF CLINICAL PEDIATRICS

By Lawrence B. Slobody, M.D., Professor of Pediatrics, New York Medical College; Director of Pediatrics, Flower and Fifth Avenue Hospitals and Metropolitan Hospital. 471 pages, 6 x 9, illustrated $7.50

McFarland: HUMAN FACTORS IN AIR TRANSPORTATION
Occupational Health and Safety

By Ross A. McFarland, Ph.D., Associate Professor of Industrial Hygiene, Harvard School of Public Health.

This timely and significant book is a direct outgrowth of the author's interest in aviation and industrial medicine during the past twenty years. In the present volume a wide range of information from the various biologic and engineering sciences has been integrated with specific problems in aviation medicine.

Many of the chapters could be applied to any industrial field such as operational fatigue, aging, and maintenance of physical and psychological fitness. The text is unique in that it integrates within one cover a wide variety of academic disciplines and technical subjects dealing with a dramatic new field of endeavor.

This study will be of great value in applying the broad principles of public health and safety to air transportation in particular and also to many other industries.

830 pages, 7¼ x 9⅞ $13.00

Order from your favorite medical book dealer or write direct to:

McGRAW-HILL MEDICAL BOOKS

McGRAW-HILL BOOK COMPANY, INC.
330 West 42nd Street • New York 36
HEALTH EDUCATION DIVISION

Please send me the books checked below for 30 days' examination on approval:

☐ Hughes ☐ Slobody ☐ McFarland

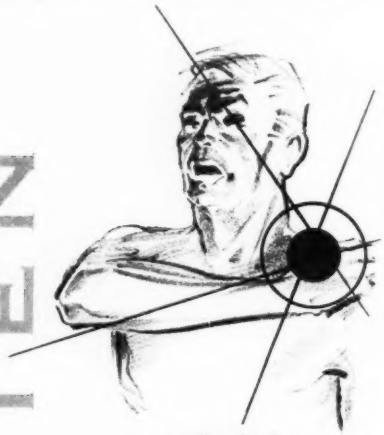
Name_____
(Please print)

Street_____ City_____

PM-6 Cash enclosed (post paid) ☐ Bill me ☐

McGRAW-HILL MEDICAL BOOKS McGRAW-HILL MEDICAL BOOKS McGRAW-HILL

NEOCYTEN
Trademark
Analgesic · Muscle-Relaxant



NEOCYTEN

to abolish the pain-spasm cycle

in neuromuscular disorders

In each NEOCYTEN* Entab*:

For Potentiated Analgesia

Sodium Salicylate . 0.25 Gm.
Para-Aminobenzoic Acid ..... 0.25 Gm.
Ascorbic Acid ... 20.0 mg.

For Safer Cholinergic Action

Physostigmine Salicylate..... 0.25 mg.
Homatropine Methylbromide . 0.50 mg.

SUPPLIED:
Bottles of 200, 500, and 1000 Entabs (enteric-coated tablets).

Samples and literature available to physicians on request

THE CENTRAL PHARMACAL CO.
Products Born of Continuous Research
SEYMOUR, INDIANA

*Trademark of The Central Pharmacal Co.

been assigned 48 hours in advance. Privatdocents have the duty of assisting the full professors in their teaching chores; they may likewise be appointed to a full professorship in their chosen specialty, and without preliminary or competitive examination, if a vacancy presents itself.

Switzerland suffers from a veritable and ever increasing plethora of physicians—a real cause of worry for the medical profession as well as the authorities. We presently have more than 7000 physicians for a population which numbers barely more than 4,000,000 people. The modest income earned today by the young physician starting out to practice is only enough to pay general expenses, taxes and insurance. It is only by mere chance or good fortune rather than native ability that he may be able, after years of long labor and precarious living, to gain a bit of security for himself. Medical fees vary considerably in different parts of Switzerland. In the French-speaking section of Switzerland the physicians are not bound by the fees set by the sickness insurance administration, and their charge for a consultation may vary between 1.5 S ($0.35) and 2.5 S ($0.65). The fees are less in the German-speaking section of Switzerland; here the charge for a consultation is between 0.8 and 1.25 S.

These remarks leave no doubt about the necessity for urgent reforms of medical education in Switzerland. However, it probably will require years of careful planning before anything will actually be done about it. Some courses in the curriculum, such as physiology, physiologic chemistry and surgical anatomy, should no doubt be enlarged. Others, on the other hand, of more or less secondary import should most likely be de-emphasized in favor of more pertinent courses. The state board (federal) examiners might well allow credit for optional work done in a branch of knowledge in which the candidate has a natural or professional interest. Provision should also be made for enabling both students and interns to orient themselves professionally according to inborn aptitudes. The final examination should probably be divided into sections which will provide a more equitable distribution of the candidate's efforts. Access to the different departments of medicine should be facilitated for those interns who want to practice general medicine.

It is not difficult to imagine some awkward situations. For example, an intern who is finan-

cially pressed and cannot afford to work a whole year for nothing in the section of internal medicine while waiting for an internship vacancy will engage himself as intern in the department of dermatology or otorhinolaryngology simply because it pays him to do so. However, years may pass before a vacancy becomes available in the department of internal medicine and thus, by force of circumstances, a young intern who had intended to practice general medicine turns out to be a specialist in dermatology or otorhinolaryngology. It would likewise be profitable to revamp the entire program of training medical specialists by accepting as diplomates only those candidates who really have satisfied a complete schedule of studies covering both theory and practice. Finally, the chiefs of the hospital clinics should have their tenure in office extended beyond the present limit of three or four years, which would be of benefit not only to themselves but also to their superiors, namely the heads of the service.

MADRID

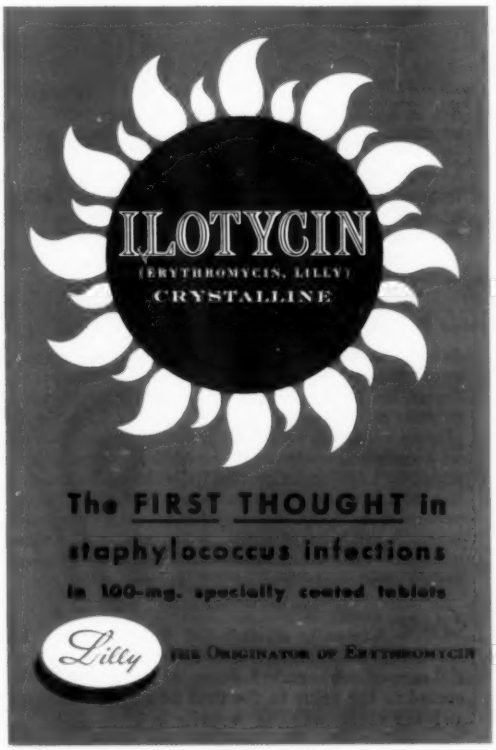
Cajal centennial closed—To close the commemoration of the first Cajal centennial, a scientific symposium was held in Madrid. Some 40 prominent persons in fields related to Cajal's work were present. The closing session, held in the classroom once used by Cajal, was addressed by Professor Jiménez-Díaz.

New services—The Social Security Bureau has opened a new building in Jaén for diagnosis and treatment, including all the medical and surgical specialties. Complete facilities are provided for better care of insured workers and their relatives.

Other new services granted by the Social Security in Madrid are those for pulmonary surgery, directed by Dr. Nistal, and for cardiovascular surgery, headed by Dr. Muñoz Calero. Both services are available to enrolled workers and relatives from the whole country as well as the service of the Labor Institute of Medicine and Hygiene, under the direction of Professor Lafuente.

Granada child care center—The Granada Board for Protection of Minors has created a new child care center, including a clinic for pediatrics and health, milk, food and medical supplies, nursery for children of women workers, and a dining room for breast-feeding mothers. This center belongs to the Agency for Protection covering the entire country and is supported by a 5 per cent tax on the value of tickets for theaters, movies, football, bullfighting and other public shows.

The inauguration was held under the presidency of Dr. Bosch Marin as Delegate of the Superior Council for Children's Protection. Assistants were the civil and military governors, the mayor of Granada, chairman and professors of the university, and the chief provincial officer of health.



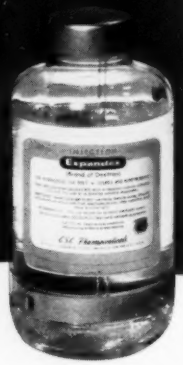
NOW AVAILABLE FOR CIVILIAN USE

Expandex®

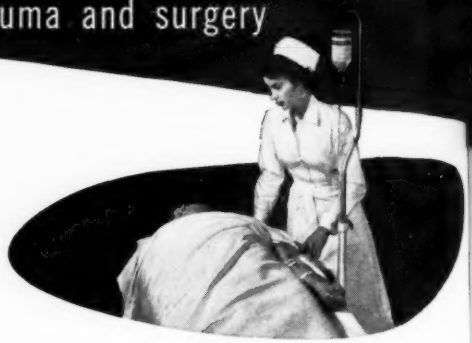
(DEXTRAN) Injection 6%

an efficient means of expanding circulating plasma volume

in the treatment of SHOCK due to hemorrhage, burns, trauma and surgery



ACCEPTED COUNCIL ON PHARMACY AND CHEMISTRY



Chemistry Expandex (Dextran) Injection, 6% is a sterile, nonpyrogenic 6% (w/v) solution of partially hydrolyzed dextran in isotonic sodium chloride solution. Dextran itself is a water soluble, high molecular weight polymer of glucose, which is produced by the action of the nonpathogenic organism *Leuconostoc mesenteroides* on sucrose. Dextran is closely related to glycogen; both these polysaccharides are made up of glucose units joined by similar linkages.

Pharmacology Given by intravenous infusion, Expandex is an efficient plasma volume expander.[1] As such it produces hemodilution manifested by a decrease in hematocrit and in total protein concentration. A 10% to 15% increase in plasma volume is produced by an infusion of 500 cc. of Expandex, while a 15% to 20% increase is produced by 1,000 cc. In normal individuals, Expandex has no influence on pulse rate, respiration, blood pressure, or ECG. No toxic effect has ever been demonstrated on kidneys, liver, and other vital organs.[2,3,4] Expandex does not interfere with blood typing, crossmatching, or RH determination.

Fate Virtually all injected Expandex can be accounted for through the experimental use of C^{14}-tagged dextran.[5,6,7] From 20% to 40% is excreted in the urine in the first 24 hours; the total urinary excretion of C^{14} activity is 65 to 75%. The bulk of the remaining radioactivity is recoverable in the expired air, indicating metabolism of dextran by the organism. About 2% is found in the feces.

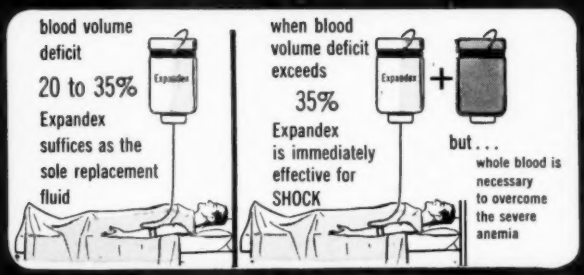
Clinical Results Expandex has been used with excellent results in all types of shock associated with a decrease in effective circulatory volume.[8,9] The plasma volume expansion it produces is maintained for periods sufficiently long to enable the circulatory system to overcome the altered dynamic state. In a typical series,[10] 52 patients in shock were given Expandex. Of these, 44 showed a good response, 5 a temporary response, and only 3 a poor response. Since it is sterile, Expandex does not carry, nor can it transmit, the virus of infectious hepatitis.

Indications and Dosage

Expandex is indicated in the treatment of shock caused by hemorrhage, burns, trauma and surgery. It can serve as the sole replacement fluid in hemorrhage when the blood deficit does not exceed 35%.[10]

Expandex is given by intravenous infusion; the average dose is 1 or 2 units (500 cc. or 1,000 cc.). A larger quantity safely may be given if required.

These laboratory and clinical findings establish **Expandex** as a safe effective plasma volume expander



52 patients
receiving Expandex for shock following
hemorrhage—burns
trauma—surgery

44	5	3
GOOD response	TEMPORARY response	POOR response

ESC *Pharmaceuticals*

A DIVISION OF
COMMERCIAL SOLVENTS CORPORATION
260 Madison Ave., New York 16, N.Y.

Clinical Advantages of Expandex

1. **It is a clinically effective and notably safe plasma volume expander, indicated in the prevention and treatment of shock due to hemorrhage, burns, trauma and surgery.**
2. **It is slowly metabolized and excreted.**
3. **It does not carry and therefore cannot transmit the virus of hepatitis.**
4. **It does not interfere with the functional activity of any organ or tissue in the body.**
5. **It does not interfere with blood typing procedures or cross-matching.**
6. **It is a nonpyrogenic and sterile solution.**
7. **It is fluid over a wide range of temperatures and is ready for immediate use.**

References

1. Witham, A. C.; Fleming, J. W., and Bloom, W. L.: The Effect of the Intravenous Administration of Dextran on Cardiac Output and Other Circulatory Dynamics, J. Clin. Investigation 30:897 (Sept.) 1951.

2. Fleming, J. W.; Cargill, W. H., and Bloom, W. L.: Effects of Intravenous Administration of Dextran on Renal Function, Proc. Soc. Exper. Biol. & Med. 79:604 (Apr.) 1952.

3. Bloom, W. L.: Dextran: A Polysaccharide for the Expansion of Plasma Volume, South. M. J. 45:457 (May) 1952.

4. Bloom, W. L.: Present Status of Plasma Volume Expanders in the Treatment of Shock; Clinical Laboratory Studies, A.M.A. Arch. Surg. 63:739 (Dec.) 1951.

5. Hellman, L.: National Research Council Report, October, 1951.

6. Terry, R., and Yuile, C. L.: Fate of Intravenous C^{14}-Labeled Dextran in Dogs, read at the 36th Annual Meeting of the American Society for Experimental Pathology, New York, April 14-18, 1952; abstracted, Federation Proc. 11:430, 1952.

7. Lathrop, K. A., and Allen, J. G.: Progress Report: Metabolism of Dextran, Quarterly Report of the Biological and Medical Research Division of the Argonne National Laboratory, in press.

8. Spence, J. H.; Higgins, A. R., and Kimmel, J. R.: The Clinical Effects of Dextran as a Plasma Volume Extender, U. S. Armed Forces M. J. 3:515 (Apr.) 1952.

9. Wilson, J. S.; Estes, E. H., Jr.; Doyle, J. T.; Bloom, W. L., and Warren, J. V.: The Use of Dextran in the Treatment of Blood Loss and Shock, Am. J. M. Sc. 223:364 (Apr.) 1952.

10. DeBakey, M. E.; Haynes, B. W., and Amspacher, W. H.: Treatment of Wound Shock, in Symposium on Shock, Washington, D. C., Army Medical Service Graduate School, May, 1951.

Additional Bibliography

Ravdin, I. S.: Plasma Expanders, J. A. M. A. 150:10 (Sept. 6) 1952.

Gropper, A. L.; Raisz, L. G., and Amspacher, W. H.: Plasma Expanders: A Collective Review, Internat. Abstr. Surg., Surg., Gynec. & Obst. 95:521 (Dec.) 1952.

Your Questions answered

Readers may send questions from their own practice or other medical problems which will be answered by qualified consultants.

• ANTABUSE AND SUICIDE

Question: Are there any qualified reports on the incidence of suicide of patients who have been taking ANTABUSE® and have returned to alcohol? Recently I had a patient who, although he had had no previous suicidal tendencies, took antabuse for a year and then began drinking. While he was still under the hangover effect of antabuse he committed suicide. Has this been previously reported or is there any scientific evidence of a connection between the two events?

M.D.—Texas

ANSWER: There are no qualified reports on the incidence of suicide of patients who have been taking antabuse and who have returned to alcohol, although some qualified observers report the development of psychotic behavior in some patients who have been placed on antabuse therapy. Scientifically it is possible that there can be a connection between the two events (taking antabuse and returning to alcohol, and suicide).

ROBERT V. SELIGER

• STERILITY PROBLEM

Question: Problem: female, 27, sterile. Investigation indicates secretory endometrium premenstrual. Hysterosalpingography indicates a hypoplastic uterus with oil extending to but not through the fimbriated ends. Can you suggest any hormonal therapy or investigative procedures? The oil insufflation is to be repeated.

M.D.—Ontario

ANSWER: I do not think, under the circumstances, that hormonal therapy would have any value. If, by further investigation, the tubes or one tube is found to be open and pregnancy does not ensue, I feel that hormonal therapy may be tried.

ROBERT D. MUSSEY

• SPOTS BEFORE THE EYES

Question: Many patients ask me about spots seen floating before the eyes and a variety of flashes in colors and formations. In many instances nothing whatever wrong can be detected in the structure of the eye. For instance, a man, aged 48, claims that he has seen these spots more in the left eye than in the right for some 20 years. He says that sometimes he can actually see the blood vessels which are frequently near but also distant. His only other complaint is headache. His vision when studied is 20/20 and he does not wear glasses. Results of all laboratory tests are negative. Some ophthalmologists who have studied him have prescribed vitamins. What is the most scientific explanation of this difficulty and is there anything to be done about it?

M.D.—New York

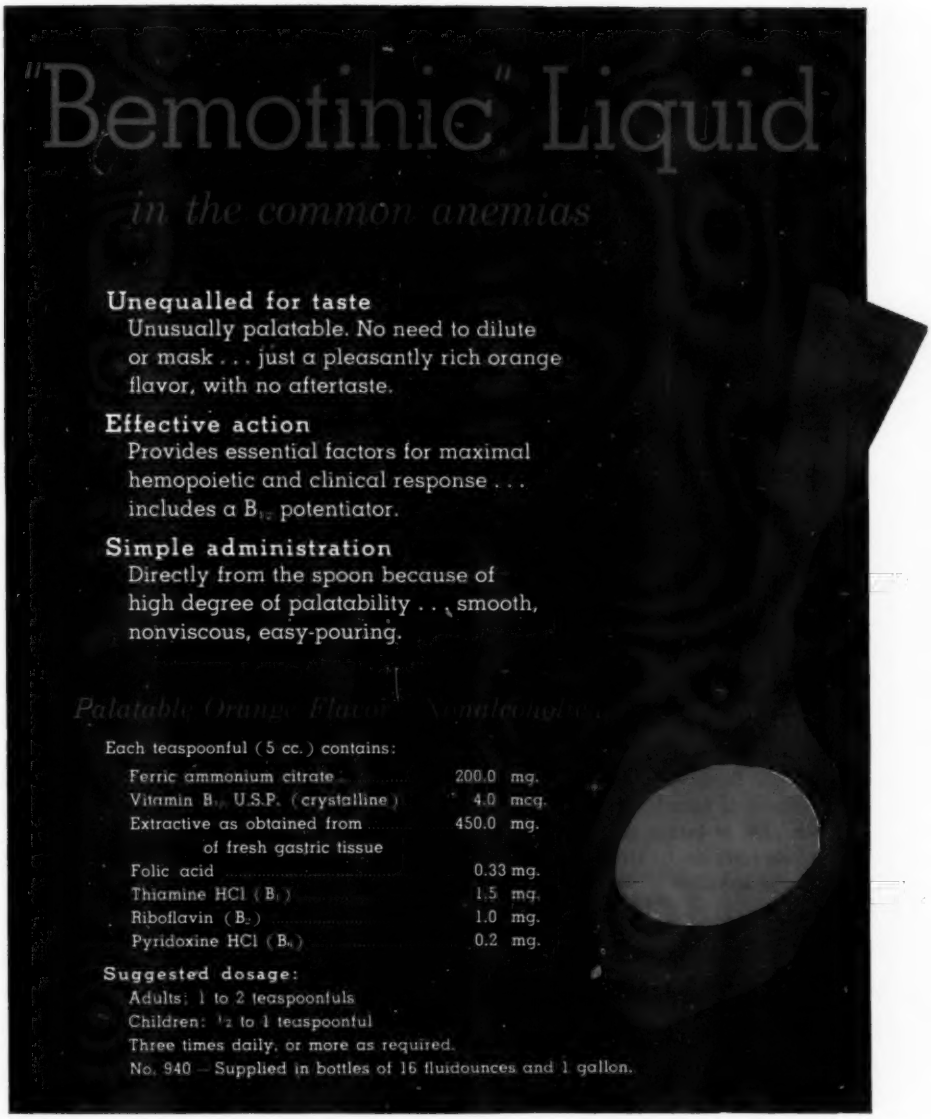
ANSWER: Many people, especially from middle age on, will complain of subjective lightning flashes and floating opacities. Occasionally these symptoms appear suddenly and will alarm the individual.

Provided separation of the retina, particularly, can be ruled out, and with the exclusion of intraocular inflammation of some sort, either affecting the choroid or the retina, such lightning flashes and floaters are almost physiologic.

The etiology has been considered as due to senile liquefaction of the vitreous so that on movement of the eye, the fluid vitreous splashes against the retina, producing the stimulus re-

(Continued on page A-28)

NEW!


"Bemotinic" Liquid
in the common anemias
Unequalled for taste
Unusually palatable. No need to dilute or mask . . . just a pleasantly rich orange flavor, with no aftertaste.
Effective action
Provides essential factors for maximal hemopoietic and clinical response . . . includes a B_{12} potentiator.
Simple administration
Directly from the spoon because of high degree of palatability . . . smooth, nonviscous, easy-pouring.
Each teaspoonful (5 cc.) contains:
Ferric ammonium citrate 200.0 mg.
Vitamin B_{12} U.S.P. (crystalline) 4.0 mcg.
Extractive as obtained from of fresh gastric tissue 450.0 mg.
Folic acid 0.33 mg.
Thiamine HCl (B_1) 1.5 mg.
Riboflavin (B_2) 1.0 mg.
Pyridoxine HCl (B_6) 0.2 mg.
Suggested dosage:
Adults: 1 to 2 teaspoonfuls
Children: ½ to 1 teaspoonful
Three times daily, or more as required.
No. 940 — Supplied in bottles of 16 fluidounces and 1 gallon.

5302

Ayerst, McKenna & Harrison Limited
New York, N. Y. • Montreal, Canada

quired to set off the retinal response, which is a flash of light. Also, as a result of the liquefaction process, fixed cells and presumably fibers of the vitreous become movable and cast shadows on the retina, which are interpreted as projected spots floating about. In younger people, and also older people with normal vitreous, muscae volitantes are common complaints.

The entoptic visualization of the retinal vessels can be produced by applying a small flashlight to the closed eyelids and moving it about. A pattern of the retinal vessels can then be projected. This is known as Purkinje's intraocular phenomenon and, therefore, it is conceivable that your patient, who is apparently introspective, may notice these retinal blood vessels under suitable conditions. Most people are not aware of them. There is nothing for the patient to do about them, except forget about them, or study the phenomena with detached scientific interest.

DERRICK VAIL

• DESTRUCTION OF HORMONES DURING PREGNANCY TESTS

Question: Our Army Medical Laboratory is attempting to write a directive for the smaller hospitals in order to avoid the destruction of pregnancy hormones (chorionic gonadotrophins) in laboratory specimens in order that the tests may be as accurate as possible; and, of course, they need some scientific basis to quote temperature range and the effects of bacterial contamination, etc. I have been able to locate very little in the literature. Can you refer me to any medical literature or supply the solution to our problem?

M.D.—Maryland

ANSWER: Chorionic gonadotrophin is stable in urine or blood serum when kept at refrigerator temperature for one and two weeks, respectively, but not longer. (Albert and Berkson, J. Clin. Endocrinol. 2:805-820, 1951.) The early literature on the subject was concerned with the value of the test and does not contain any specific method of the urine collection. Heating urine and blood serum to temperatures above 60° C. will destroy the biologic potency of chorionic gonadotrophin. The effects of bacterial contamination are not well known.

ROBERT D. MUSSEY

• ANXIETY SYMPTOMS AFTER CORONARY THROMBOSIS

Question: A man, aged 67, had a definite coronary thrombosis at the age of 65. Following long-continued care in the hospital, he was convalescent and after seven months resumed complete work. Now he complains of pain in the roof of the mouth with some swelling at intervals. He also has what he describes as "hot flashes" and considerable anxiety as to his physical condition. Complete examination of the heart, including x-ray studies, indicates that there is no definite disturbance that can be detected related to the heart. What are the suggestions in a case of this type?

M.D.—Missouri

ANSWER: The only suggestion that I can think of to help this patient is sedation such as phenobarbital, ½ gr., four times a day.

WILLIAM D. STROUD

• ASTHMA AND BEDBUG BITES

Question: I have just read a report of a Spanish physician who claims that 3 out of 4 patients with asthma whom he saw have been sensitized by the bites of bedbugs. Three of the patients improved when they changed their residence to a building in which such insects were absent. Routine intradermal tests for the usual sensitizers such as fungi, pollens, housedust, wool, feathers, hair and the like were negative, whereas tests made with extracts of bedbugs were strongly positive in these 3 patients but negative in others. What is the opinion of allergists as to the reality of material from the bedbug as a sensitizer?

M.D.—Tennessee

ANSWER: While I have never seen a case of asthma due to a sensitivity to the bedbug, such cases have been reported in the literature and are accepted as definite evidence of the existence of such an allergen. The following references are suggested:

STERNBERG, L.: J. Allergy 1:83, 1929.
LAHOZ, C. and RECATERO, L.: Rev. clín. españ. 5:361, 1942.
JIMENEZ, DIAZ and SANCHEZ-CUENA: J. Allergy 6:397, 1935.

HARRY L. ROGERS

"...failure, according to some of the newer evidence...touches off at once a mechanism that hungrily promotes the tubular reabsorption of sodium, just the sort of thing that the mercurials combat so well."*

...and none better than

MERCUHYDRIN®

intramuscularly

subcutaneously or

intravenously

*Beckman, H.: Pharmacology in Clinical Practice, Philadelphia, W. B. Saunders Company, 1952, p. 171.

MERCUHYDRIN

(brand of meralluride, U.S.P.) *sodium*

Ampuls of 1 cc. and 2 cc. and 10-cc. vials

Leadership in diuretic research

Lakeside LABORATORIES, INC., MILWAUKEE 1, WISCONSIN

THE MEDICAL *Bookman*

► THE 1952 YEAR BOOK OF OBSTETRICS AND GYNECOLOGY

Edited by J. P. Greenhill, M.D., Professor of Gynecology, Cook County Graduate School of Medicine, Chicago. 575 pages. 1952, The Year Book Publishers, Inc., Chicago. $5.50.

Under the able editorship of J. P. Greenhill. this Year Book furnishes year after year an excellent resumé of the literature on obstetrics and gynecology. This year the book gives an excellent review of the complications of pregnancy, normal and complicated labor and operative obstetrics. The postpartum period and the care of the newborn child are described. Over 300 magazine articles were reviewed by the editor.

Fertility is considered and numerous methods for the relief of infertility are outlined. Pulmonary tuberculosis and tuberculosis of the pelvic organs complicating pregnancy are discussed. Technic of operations is reviewed and the reasons for various technics are covered. In all of this, the editor gives the reader his opinion of the technics and the treatments.

Fetal mortality and the management of its various causes are discussed—that is, the deaths caused by prematurity, erythroblastosis, obstetric trauma, pneumonia and congenital anomalies, as well as intrauterine asphyxia. It is evident that most infant deaths occur in the first 24 hours and that fetal mortality is gradually being lowered by thorough understanding of its causes.

The general principles of gynecology start with a description of weakness in the anterior vaginal wall which is partly responsible for incontinence of urine. Various operations are described for urethrocele and for cystocele. Newer methods of treatment of infestations of the vagina, such as by *Trichomonas,* are also outlined. The diagnosis of pathologic conditions of the pelvis is considered in various articles and, again, infertility is thoroughly covered. Infections and benign and malignant tumors and their management are described by various authors. The question of endometriosis is thoroughly considered. The treatment of menstrual disorders by operative measures and by hormones is presented, as well as the general subject of endocrinology. The question is discussed of preserving apparently normal ovaries at the time of surgery, especially because of the carcinoma of the ovaries which may result.

R. D. M.

► PRACTICAL DERMATOLOGY FOR MEDICAL STUDENTS AND GENERAL PRACTITIONERS

By George M. Lewis, M.D., Professor of Clinical Medicine (Dermatology), Cornell University Medical College. 328 pages with 99 figures. 1952, W. B. Saunders Company, Philadelphia & London. $7.50.

Here is a textbook which covers all phases of dermatology ranging from diagnostic methods through the various dermatologic conditions, with a chapter on therapy and still another one covering formulary. There is a good division of the subject matter in separate chapters such as the Eczematous Dermatoses, the so-called Collagen Diseases, Pyodermas, etc. The grouping and comparison are well taken. Each dermatosis is handled in outline form, none in great detail. This is understandable in a textbook of 296 pages.

This is a well developed text which reads easily and is very well illustrated. It is more than just a listing of dermatitides and represents one of the better small texts for medical students and general practitioners.

I. F.

(Continued on page A-52)

ARE YOU
USING THESE FREE SERVICES?

They can save you many hours of consultation time—help your patients follow your directions accurately!

These services are:

- *Prepared by a graduate dietitian*
- *Checked by physicians and nutrition authorities*
- *Professional in appearance and content*
- *Quickly adjustable to your own methods and to each patient's individual needs*

FOR YOUR YOUNG PATIENTS

Pediatric Feeding Direction Forms—For 4 age groups, from birth through pre-school.

Coloring Book—For you to give the youngsters! Appealingly emphasizes health practices.

FOR WEIGHT-CONTROL

Four Reducing Diets — For adults and teen-age girls. (800, 1200, 1500 and 1800 calories)

Guide to Maintaining Ideal Weight—Contains calorie count of over 400 foods.

Normal and Gaining Diets — Flexible enough for adults and children.

FOR OBSTETRICAL PATIENTS

Diet for Pregnancy—Outlines sound dietary regimen for normal pregnancy, including directions for preventing excessive weight gains.

FOR ALLERGY PATIENTS

Wheat-Free, Egg-Free, Milk-Free and Diagnostic Diets. Also 14-Day Food Diary.

MAIL THIS COUPON TODAY FOR KIT OF SAMPLE COPIES

For your convenience in ordering those you wish in quantity, postage-free card is included in kit.

RALSTON PURINA COMPANY
3R-7 Checkerboard Square, St. Louis 2, Mo.
Send 1 Kit No. C2872 to:

*Name*_____ *M.D.*

*Address*_____

*City*_____ *Zone*____ *State*_____

► DISORDERS OF THE CIRCULATORY SYSTEM

Edited by Robert L. Craig, M.D. Presented at the Twenty-Fourth Graduate Fortnight of The New York Academy of Medicine, October 8 to 19, 1951. 305 pages with 87 figures. 1952, The Macmillan Company, New York. $5.50.

The contents of this book consist of addresses delivered by various prominent investigators in clinical cardiology and the basic sciences on the occasion of the Annual Fortnight Lecture Series of the New York Academy of Medicine. It is remarkable that some phase of practically every major area of modern cardiovascular problems receives consideration within the confines of this modest little volume. Included are discussions of timely aspects of atherosclerosis, coronary disease, electrocardiography, hypertension, cardiac surgery, infectious disease of the heart, congestive failure, peripheral vascular disease, histopathology of "collagen" disorders, biochemistry of the contractile process, and psychosomatic aspects of circulatory diseases.

To regular readers of the *Bulletin of the New York Academy of Medicine*, to cardiologists abreast of their specialty, and to investigators in the field, this book will serve largely as a refresher and thumbnail reference. On the other hand, medical students, practitioners, internists and investigators in other disciplines will find this an invaluable source book of contemporary thinking and research in the field of circulation. The articles are uniformly characterized by well sifted, analytic resumés of current concepts; unanswered problems are provocatively pointed up; and a serviceable core of major references is in each instance appended. Workers in the field will take issue with the emphasis or viewpoint assumed at times by some of the authors, but these are of minor consequence to those for whom this volume is intended.

L. N. K.

► 1952 YEAR BOOK OF GENERAL SURGERY

Edited by Evarts A. Graham, M.D., Emeritus Professor of Surgery, Washington University School of Medicine, St. Louis. 670 pages, 208 illustrations. 1952, The Year Book Publishers, Inc., Chicago. $6.00.

Keeping abreast with current medical literature is as necessary for the progressive general practitioner as the specialist, but this may be a time-consuming as well as a practical impossibility for the busy physician. This Year Book presents in abstract form the outstanding contributions published in American and selected foreign surgical literature from June 1951 to May 1952. The last part of the book is devoted to anesthesia.

Phases of surgery of greater interest to the practitioner appear to be covered in greater detail. For example, in the section on stomach and duodenum 30 articles are summarized and on the topic of gallbladder disease 23 papers are abstracted. Appropriate editorial comment follows many of the articles. Some of the phases covered are hypertrophic pyloric stenosis, relation of gastric secretion to events following pyloric obstruction, significance of duodenal diverticula, modern treatment of massive hemorrhage of peptic ulcer origin, effect of various surgical procedures on acidity of gastric content of surgical patients, safeguards in gastric resection for duodenal ulcer and vagotomy versus gastric resection.

Significant contributions on premedication, inhalation anesthesia, local anesthesia, and muscle relaxants are a few of the subdivisions included in the section on anesthesia.

Throughout, the emphasis is placed on the more practical aspects of diagnosis and treatment of surgical problems rather than on the pure research aspects.

Y. S.

► STERILITY: ITS CAUSE AND ITS TREATMENT

By J. Jay Rommer, M.D., Beth Israel Hospital, Newark. 424 pages with 259 illustrations. 1952, Charles C Thomas, Springfield, Illinois. $12.50.

In this treatise the author has embraced all aspects of the reproductive problem, an extremely complicated and intricate subject. At the outset Dr. Rommer explains the physiology of fertilization and discusses anatomy of the normal female and the changes caused by anomalies, inflam-

(Continued on page A-54)

Why

for your ALLERGY PATIENTS

Your patients on restricted diets will appreciate the delicious rye flavor of Ry-Krisp—most often prescribed as *the* bread in allergy diets.

Ry-Krisp supplies the protein, minerals, and B-vitamins of whole-grain rye in a crisp and appetizing form.

No Wheat...

No Milk...

No Egg...

No Yeast...

Just Whole-grain Rye, Salt, and Water

There is only ONE RY-KRISP

Ry-Krisp is milled, mixed, baked and packaged under rigidly controlled conditions, *completely safeguarded* from contamination by other food substances. TELL YOUR PATIENTS TO LOOK FOR THE NAME **"RY-KRISP"** ON THE PACKAGE AND ON EACH WAFER.

FREE SERVICES—*Wheat-free, egg-free, milk-free, diagnostic diets; 14-day food diary. Each available in pads for patient use. For sample copies, write: Ralston Purina Company, Nutrition Service, St. Louis 2, Mo.*

mation or growths in the generative tract. He shows the normal fertilization process and the errors which arise from a disturbance of this process. Emotional reactions due to the effect of faulty thinking or habits of either mate are pointed out.

The author outlines the indications and contraindications for the medical treatment of infertility. He gives the management of threatened abortion, starting with rest and diversion of the mind of the patient and proceeding with the uses of hormones and other medication. As every effort is made to conserve the pregnancy, emptying the uterus is the last resort.

Various treatments to increase the percentage of full term pregnancies are presented. The treatment of moniliasis is given.

The surgical maneuvers employed to enable fertilization of the ovum are described, including relief of vaginal, cervical and uterine atresia and operations for retroposition and tumors of the uterus, tumors of the ovaries and of the tubes.

The author states that artificial insemination should be considered only when all other methods have failed. The baby (resulting from artificial insemination) can be legitimized by the husband's adopting the child. In the opinion of the reviewer, the procedure of artificial insemination can be practiced only when a good lawyer has passed on the procedure.

R. D. M.

► ESSENTIALS OF INFANT FEEDING FOR PHYSICIANS

By Herman Frederic Meyer, M.D., Assistant Professor of Pediatrics, Northwestern University School of Medicine, Chicago. 252 pages with 13 illustrations. 1952, Charles C Thomas, Springfield, Illinois. $6.75.

It is true that every textbook of pediatrics devotes at least one chapter to the subject of infant feeding and that many monographs on the chemistry and physiology of the science of infant feeding can be found in any medical library; yet this practical text for rapid reference is in a way an original departure from the run of the mill and contains many essential facts that cannot be found elsewhere.

Puzzled by the fact that infant feeding has become confused and complicated when it should be simple and cogent, Dr. Meyer inventoried all the available infant foods, from fresh milks to soybean preparations. At the end of three years, through questionnaires sent to 26 companies, he found 58 products, 27 modifiers and 460 brands.

Every pediatrician with any clinical experience in infant feeding knows that the quality, uses and merits of most of these proprietaries are essentially the same and that for the normal child no more than a half a dozen products are necessary for optimum growth and development.

What has been said of foods applies also to vitamins. According to the author, there is probably no field of medical therapy which today is as exploited and misused, not only by the consumer and the druggist, but also by the average practitioner.

In the chapter on "Psychological Feeding Problems," the author stresses the fact that successful infant feeding must go further than a comprehensive knowledge of milk mixtures and vitamin requirements and must give equal consideration to all the psychologic and emotional factors that have an impact upon the child's behavior responses.

As a final word of approval the reviewer would like to call favorable attention to the last 35 pages of the appendix, which contain valuable practical data useful in infant feeding, indexes on the development of a normal infant, economic consideration by the physician of the families' pocketbooks, procedures in parenteral fluid administration, accessory feeding equipment, and many other miscellaneous suggestions which will prove invaluable in infant care.

M. S.

Books received will be acknowledged in this department each month. As space permits, books of principal interest to our readers will be reviewed more extensively.

The Principles of Neurological Surgery. By Loyal Davis, M.D., Professor of Surgery, Northwestern University Medical School, Chicago. Ed. 4. 544 pages with 186 figures. 1953, Lea and Febiger, Philadelphia. $8.50.

Familial Nonreaginic Food-Allergy. By Arthur F. Coca, M.D., Oradell, New Jersey. Ed. 3. 279 pages. 1953, Charles C Thomas, Springfield, Illinois. $10.50.

(Continued on page A-56)

Whole Wheat

IN ITS MOST DELICIOUS, CONVENIENT FORM

When the convenience offered by a ready-to-eat cereal is required to assure the patient's cooperation, many doctors recommend

WHEAT CHEX!

WHEAT CHEX is made of whole wheat, ready to eat without fixing.

It's bite size for easy eating. Specially prepared for easy digestion. Has a delicious flavor that stimulates lagging appetites. Lasting crispness in cream or milk to make the last bite as tempting as the first.

Recommend **WHEAT CHEX** for breakfast—for between-meal and bedtime snacks instead of sweets.

DELICIOUS! NUTRITIOUS!

IT'S WHOLE WHEAT!

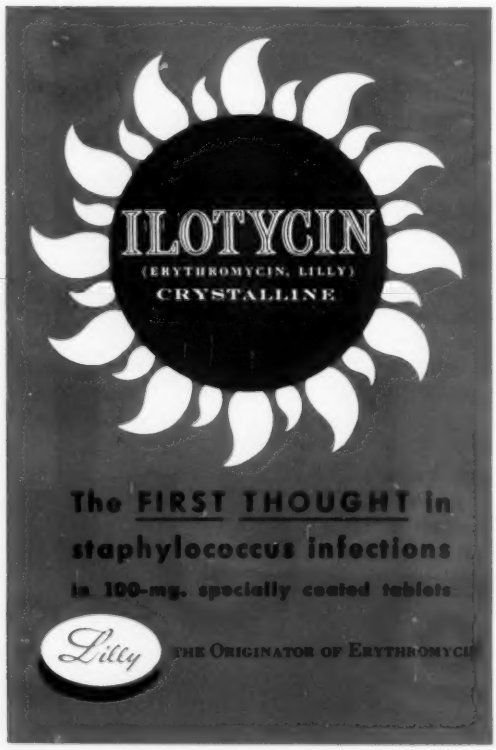
Clinical Applications of Suggestion and Hypnosis. By William T. Heron, Ph.D., Professor of Psychology, University of Minnesota, Minneapolis. Ed. 2. 137 pages. 1953, Charles C Thomas, Springfield, Illinois. $3.75.

Second Annual Report on Stress. By Hans Selye, M.D. and Alexander Horava, M.D., Institut de Médecine et de Chirurgie expérimentales, Université de Montréal. 526 pages. 1952, Acta, Inc., Medical Publishers, Montreal, Canada.

Endocrine Treatment in General Practice. Edited by Max A. Goldzieher, M.D., Goldwater Memorial Hospital, New York and Joseph W. Goldzieher, M.D., Research Associate, New York Medical College. 474 pages, illustrated. 1953, Springer Publishing Company, Inc., New York. $8.00.

Gynecological and Obstetrical Pathology. By Peter A. Herbut, M.D., Professor of Pathology, Jefferson Medical College, Philadelphia. 683 pages with 246 figures. 1953, Lea & Febiger, Philadelphia. $12.50.

Handbook of Orthopaedic Surgery. By Alfred Rives Shands, Jr., M.D., Medical Director, Alfred I. duPont Institute de Nemours Foundation, Wilmington, Delaware, in collaboration with Richard Beverly Raney, M.D., Professor of Orthopedic Surgery, University of North Carolina, Chapel Hill, North Carolina. Ed. 4. 644 pages with 192 illustrations. 1952, The C. V. Mosby Company, St. Louis. $8.00.



Office Management of Ocular Diseases. By William F. Hughes, Jr., M.D., Professor and Head, Department of Ophthalmology, University of Illinois College of Medicine, Chicago. 452 pages with 120 figures. 1953, The Year Book Publishers, Inc., Chicago. $9.00.

Clinical Electrocardiography in Children. By Gertrude H. B. Nicolson, M.D., Instructor in Pediatrics, Columbia University. 118 pages with 58 figures. 1953, The Macmillan Company, New York. $3.25.

Diseases of the Heart and Arteries. By George R. Herrmann, M.D., Professor of Medicine, University of Texas. Ed. 4. 652 pages with 215 figures and 4 color plates. 1952, C. W. Mosby Company, St. Louis. $12.50.

Treatment of Mental Disorder. By Leo Alexander, M.D., Director, the Neurobiological Unit, Division of Psychiatric Research, Boston State Hospital. 507 pages with 143 figures. 1953, W. B. Saunders Company, Philadelphia and London. $10.00.

The Anatomy of the Nervous System. By Stephen Walter Ranson, M.D., Late Professor of Neurology and Director of Neurological Institute, Northwestern University Medical School, Chicago. Ed. 9. 581 pages with 434 illustrations. 1953, W. B. Saunders Company, Philadelphia and London. $8.50.

American Pocket Medical Dictionary. Ed. 19. 639 pages. 1953, W. B. Saunders Company, Philadelphia and London. $3.25 plain; $3.75 with thumb-index.

A Manual of Clinical Allergy. By John M. Sheldon, M.D., Professor of Internal Medicine; Robert G. Lovell, M.D., Instructor in Internal Medicine, and Kenneth P. Mathews, M.D., Assistant Professor of Internal Medicine, University of Michigan Medical School. 413 pages with 27 figures. 1953, W. B. Saunders Company, Philadelphia and London. $8.50.

Gifford's Textbook of Ophthalmology. By Francis Heed Adler, M.D., Professor of Ophthalmology, University of Pennsylvania Medical School. Ed. 5. 488 pages with 281 figures and 26 color plates. 1953, W. B. Saunders Company, Philadelphia and London. $7.50.

Pheochromocytoma and the General Practitioner. By Joseph L. DeCourcy, M.D. and Cornelius B. DeCourcy, M.D. 165 pages. 1952, DeCourcy Clinic, Cincinnati.

Pulmonary Hyaline Membranes. Report of the Fifth M & R Pediatric Research Conference. Chairman: Waldo E. Nelson, M.D., Professor of Pediatrics, Temple University School of Medicine, Philadelphia. 94 pages, illustrated. Copies available from M & R Laboratories, Columbus 16, Ohio.

Practical Clinical Chemistry. By Alma Hiller, Ph.D., Associate Professor of Biological Chemistry, University of Illinois College of Medicine, Chicago. 266 pages. 1953, Charles C Thomas, Springfield, Illinois. $6.50.

The Pharynx: Basic Aspects and Clinical Problems. Edited by Abraham R. Hollender, M.D., Professor of Otolaryngology, Emeritus, University of Illinois College of Medicine, Chicago. 560 pages with 31 figures. 1953, The Year Book Publishers, Inc., Chicago. $15.00.